EXHIBIT 33

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

CHR. HANSEN HMO GMBH, *Plaintiff and Counterclaim-Defendant*, v. GLYCOSYN LLC, *Defendant and Counterclaim-Plaintiff*, v. ABBOTT LABORATORIES, *Counterclaim-Defendant*.	C.A. No. 1:22-cv-11090-NMG **JURY TRIAL DEMANDED**

DECLARATION OF DR. KRISTALA L. JONES PRATHER IN SUPPORT OF COMPLAINANT GLYCOSYN LLC'S INITIAL CLAIM CONSTRUCTION BRIEF

I. INTRODUCTION

I, DR. KRISTALA L. JONES PRATHER, declare and state as follows:

1. My name is Kristala L. Jones Prather. I have been retained by counsel for Defendant and Counterclaim-Plaintiff Glycosyn LLC ("Glycosyn") as an expert to provide my opinion regarding the appropriate claim construction of terms in United States Patent No. 9,970,018 ("the '018 Patent") (the "Asserted Patent"). I have been asked to analyze how a person of ordinary skill in the art would have understood the claim terms in question at the time of invention of the Asserted Patent. I have personal knowledge of all the facts set forth herein.

2. I am being compensated at my hourly rate of $650. I am also being separately reimbursed for out-of-pocket expenses. My compensation does not depend in any way on the outcome of this litigation or the particular testimony or opinions I express.

3. I understand that Glycosyn is asserting claims 1-3, 5, 7, 8, 10, 12, 18, and 23-28 of the '018 Patent against Chr. Hansen HMO GmbH ("Chr. Hansen") and Abbott Laboratories ("Abbott") (collectively, "Counterclaim-Defendants") in this litigation.

II. EXPERT QUALIFICATIONS

4. I am the Arthur D. Little Professor in the Department of Chemical Engineering at the Massachusetts Institute of Technology ("MIT") in Cambridge, Massachusetts.

5. I have been a professor in the Department of Chemical Engineering at MIT since 2004, and was granted tenure in 2013. Prior to my time at MIT, I was a Senior Research Biochemical Engineer between 2000 and 2003 and a Research Fellow between 2003 and 2004 in the Bioprocess Research and Development group at Merck Research Labs in Rahway, New Jersey. While in graduate school for my Ph.D. in Chemical Engineering, I was also employed as a Research Assistant and a Graduate Student Instructor in the Department of Chemical Engineering at the University of California in Berkeley, California.

6. I earned a Doctorate of Philosophy in Chemical Engineering at the University of California, Berkeley, in December of 1999, with Jay D. Keasling as my Research Advisor. My dissertation was entitled "Development of Low-Copy Expression Vectors Derived from the F Plasmid of *Escherichia coli*." I also earned a Bachelor of Science in Chemical Engineering from MIT, in May of 1994.

7. I am a named inventor on seven patents:

   i. "Methods for microbial production of terpenoids." US Patent No. 8,062,878. Issued November 22, 2011.

   ii. "Microbial production of 3-hydroxyacids from glucose and glycolate." US Patent No. 8,361,760. Issued January 29, 2013.

iii. "Microbial production of 3,4-dihydroxybutyrate (3,4-DHBA), 2,3-dihydroxybutyrate (2,3-DHBA) and 3-hydroxybutyrolactone (3-HBL)." US Patent No. 8,669,379. Issued March 11, 2014.

iv. "Glucose valve and other metabolite valves." US Patent No. 8,835,138. Issued September 16, 2014.

v. "Cellular production of glucaric acid through recombinant expression of uronate dehydrogenase and myo-inositol oxygenase." US Patent No. 8,835,147. Issued September 16, 2014.

vi. "Microbial production of branched medium chain alcohols, such as 4-methylpentanol." US Patent No 10,100,335. Issued October 16, 2018.

vii. "Microbial system for biosynthesis of natural and engineered products coupled to *in situ* extraction in supercritical CO_2." US Patent No 10,941,379. Issued March 9, 2021.

8. I have over one hundred twenty publications in in my field. For a list of publications, see my curriculum vitae (CV), which is attached as Appendix A, or my research group website, http://prathergroup.mit.edu.

9. I am a member of the following organizations: American Chemical Society, BIOT Division; American Institute of Chemical Engineers; Society for Industrial Microbiology & Biotechnology; Society for Biological Engineering; National Organization for the Professional Advancement of Black Chemists and Chemical Engineers.

10. A full listing of my education, experience, and other qualifications can be found in my curriculum vitae (CV), which is attached as Appendix A.

III. MATERIALS CONSIDERED

11. In forming the opinions set forth in this Declaration, I have considered and relied upon my education, knowledge of the relevant field, and experience. I have also reviewed and considered the Asserted Patent and its prosecution history; the Joint Claim Construction Statement submitted by the Parties; and other materials expressly cited. I have also considered all documents and evidence provided in this Declaration.

12. I have also considered my testimony, and the testimony of Counterclaim-Defendant Chr. Hansen's expert, offered in the investigation involving Glycosyn and Chr. Hansen's predecessor (Jennewein Biotechnologie GmbH) before the International Trade Commission ("ITC"), *Certain Human Milk Oligosaccharides and Methods of Producing the Same*, Inv. No. 337-TA-1120.

13. I understand that I may be called on to testify in this matter at a claim construction hearing and therefore reserve the right to consider and/or rely upon any additional information or materials that may be provided to me or that are relied upon by any of the Counterclaim-Defendants' experts or witnesses.

14. I understand that discovery in this litigation is still ongoing. I may therefore consider additional facts and materials produced through discovery to determine whether such additional materials have an impact on my opinions.

IV. CLAIM CONSTRUCTION LEGAL STANDARDS

15. In preparation for forming the opinions set forth in this declaration, I have been informed by counsel of legal principles relevant to claim construction.

16. I have been informed that the claims of a patent must be read from the viewpoint of a person of skill in the art. I also understand that claim language should be interpreted in

accordance with its ordinary and customary meaning unless the patent or prosecution history unambiguously dictates that a different claim meaning was intended.

17. I have been informed by counsel that a claim term is to be given the meaning that a person of skill in the art at the time of invention would understand it to have, as used in the patent claims at issue, and in the context of the entire patent (including the specification).

18. I have also been informed that, in endeavoring to understand the meaning of a claim term, the most significant evidence to be referenced is the patent itself (including the specification and patent claims) and the prosecution history of the patent. I also understand that evidence "extrinsic" to the patent, such as scientific articles, is generally considered to be less significant for purposes of interpreting claim language.

19. I have been informed that while understanding the claim language may be aided by explanations contained in the written description or specific "embodiments" or examples of how the invention can be deployed, it is important not to import into the claims limitations from the specification when the claim language is not so limited.

20. I have been informed that a claim construction that does not include preferred embodiments disclosed in a patent specification is rarely, if ever, correct.

21. I also understand that a patent applicant may use a term in a manner that differs from the ordinary meaning of that term (as understood by a person of skill in the art) if the patent sets out that different meaning in a manner sufficient to inform a person of skill in the art. I understand that to redefine a term and act as a lexicographer, a patentee must clearly set forth a definition of the disputed claim term or express a clear intention to redefine the term.

V. PERSON OF ORDINARY SKILL IN THE ART

22. The field of the Asserted Patent pertains to genetic engineering of microorganisms to produce certain oligosaccharides.

23. It is my opinion that a person of ordinary skill in the art of genetically engineering microorganisms would have a Ph.D. in molecular biology, biochemistry, biological or chemical engineering, or an equivalent field, and 1-2 years of experience working with *E. coli* bacteria or related systems. Alternatively, a person of ordinary skill in the art would have a lower level degree (*e.g.*, a Master of Science) in a similar field to those listed above, but with a greater amount of relevant working experience (*e.g.*, 5-6 years of experience working with *E. coli* bacteria or related systems).

24. I meet this criteria and I consider myself a person with at least ordinary skill in the art pertaining to the Asserted Patent. In addition, I would have been a person of ordinary skill in the relevant art at the time of the inventions of the Asserted Patent.

VI. U.S. PATENT NO. 9,970,018

25. The ’018 Patent is entitled “Biosynthesis of Human Milk Oligosaccharides in Engineered Bacteria.” Ex. 1 (U.S. Patent No. 9,970,018, “’018 Patent”) at 1. It was filed on September 21, 2017, and issued on May 15, 2018, with 28 claims. The ’018 Patent is a continuation of Application No. 14/442,131, filed February 24, 2017, which is a continuation of Application No. 14/033,664, filed September 23, 2013, which is a divisional of Application No. 13/398,526, filed February 16, 2012, which claims priority to provisional Application No. 61/442,470, filed February 16, 2011. *Id.*

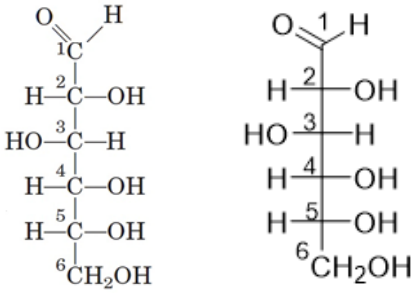
26. The Asserted Patent teaches those skilled in the art how to engineer a bacterium to produce oligosaccharides, in particular certain fucosylated and/or sialylated oligosaccharides that are typically found in human milk.

VII. BACKGROUND OF THE ART

27. Human milk oligosaccharides ("HMOs") are a subgroup of sugars contained within human milk that provide infants with several immune and digestive benefits. The patented technology involves the synthesis of certain human milk oligosaccharides via the bioengineering of microorganisms. Scientists have been genetically engineering microorganisms to produce biological molecules for decades. Genetic engineering allows scientists to avoid many of the limitations prevalent in "traditional" chemical synthesis methods, such as: chemical structure specificity issues (known as stereochemistry), availability of starting ingredients, product impurities, and high overall cost.

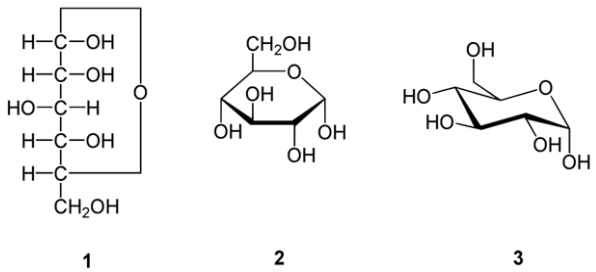
A. The Chemistry and Structure of Sugars

28. Sugars are carbohydrates, and biochemists call sugars "saccharides." Saccharides typically have names ending in "–ose" and, as the term "carbohydrates" implies, are biological molecules made up of carbon (C), hydrogen (H), and oxygen (O). Monosaccharides, also known as simple sugars, are the fundamental units of carbohydrates. Ex. 2 (Lodish *et al.*, Molecular Cell Biology, 6th ed. (2008)) at GLY-ITC1120_0122271 - GLY-ITC1120_0122272. One common example of a monosaccharide is glucose. *Id.*; Ex. 3 (Tien Nguyen, Synthesizing Mother's Milk, Chemical & Engineering News, 26-29 (July 2, 2018)) at GLY-ITC1120_0026824 - GLY-ITC1120_0026825. The monosaccharide glucose is depicted using two different drawing conventions below.



Glucose in Chain Formation

29. In nature, glucose and other monosaccharides can exist in multiple forms depending on the conditions—such as temperature, solvent, pH, etc. *See* Ex. 2 (Lodish) at GLY-ITC1120_0122271 - GLY-ITC1120_0122273. The two classical forms for sugars having the same chemical formula (such as $C_6H_{12}O_6$: *i.e.*, six carbon atoms, twelve hydrogen atoms, and six oxygen atoms) are either an open chain (see figure above) or a cyclic ring (see figure below). *See id.* Within each chain or ring structure, a sugar molecule can have further different physical configurations, rotations, and spatial orientations. Therefore, the same monosaccharide molecule can exist in a large variety of chemical configurations, which can be depicted pictorially in a variety of ways. The figure below shows the same glucose in a cyclic ring form depicted in three ways. The first depiction is two-dimensional. The second and third depictions show two different three-dimensional configurations.



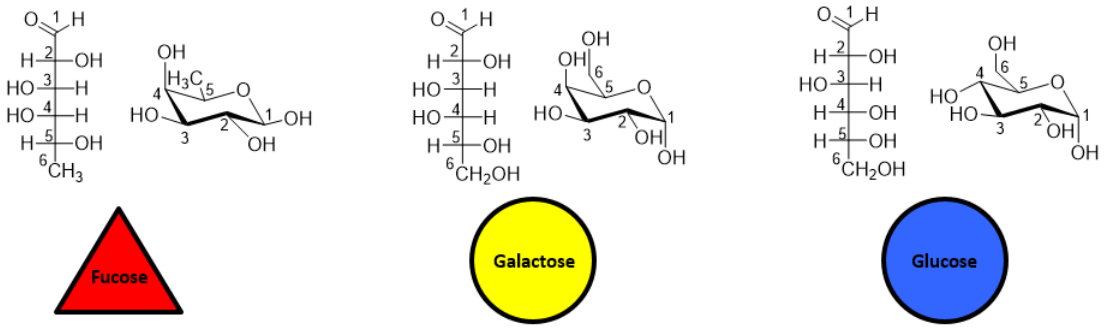
1 2 3

Glucose in Cyclic Ring Formation

30. Monosaccharides can be linked to form disaccharides (two monosaccharides linked) and oligosaccharides (three to ten monosaccharides linked). Ex. 2 (Lodish) at GLY-ITC1120_0122273. A common disaccharide is lactose, which is found in milk and consists of one molecule of glucose linked to one molecule of another monosaccharide, galactose. There are hundreds of different monosaccharides, disaccharides, and oligosaccharides.

B. Human Milk Oligosaccharides (HMOs)

31. All HMOs consist of the same five monosaccharides: glucose, fucose, galactose, N-acetylglucosamine, and N-acetylneuraminic acid. *See* Ex. 3 (Nguyen) at GLY-ITC1120_0026825; Ex. 2 (Lodish) at GLY-ITC1120_0122272 - GLY-ITC1120_0122273. The monosaccharides most relevant to the patented technology in this case are glucose, galactose, and fucose, as they make up 2′-FL and 3-FL. They are depicted below:



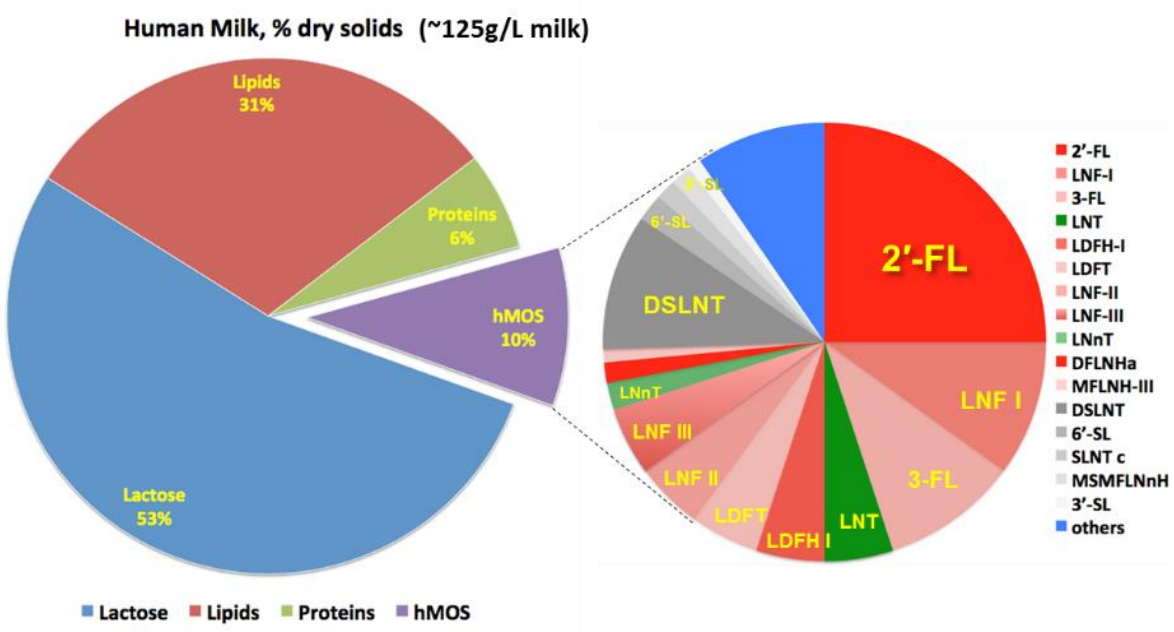
Fucose, Galactose, and Glucose

32. As discussed above, HMOs are a subgroup of sugars within human milk that provide infants with several immune and digestive benefits. The demonstrated health benefits of HMOs include exhibiting antibacterial and antibiofilm properties against several strains of bacteria, decreasing the incidence of infectious diarrhea in breast-fed infants, encouraging the

population of beneficial bacteria, boosting infant immune systems, and altering intestinal cell response by decreasing attachment sites for pathogens. Ex. 8 (Florian Baumgärtner et al., Construction of Escherichia coli strains with chromosomally integrated expression cassettes for the synthesis of 2′-fucosyllactose, 2 (2013)) at GLY-ITC1120_0086026.

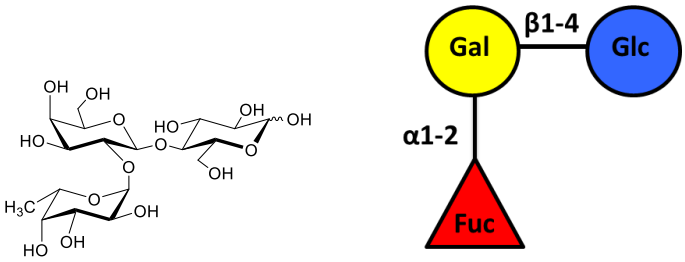
33. HMOs play significant roles in the protection and development of human infants, particularly in the infant gastrointestinal (GI) tract. *See* '018 Patent at 1:37-39 (HMOs "serve critical roles in the establishment of a healthy gut microbiome, in the prevention of disease, and in immune function."); Ex. 3 (Nguyen) at GLY-ITC1120_0026824. Specifically, HMOs exhibit antibacterial and antibiofilm properties against several strains of bacteria, decreasing the incidence of infectious diarrhea in breast-fed infants, encouraging the population of beneficial bacteria, boosting infant immune systems, and altering intestinal cell response by decreasing attachment sites for pathogens. *See* Ex. 9 (Lars Bode, Human milk oligosaccharides: Every baby needs a sugar mama, 1147-1162, GLYCOBIOLOGY 22, no. 9 (September 2012)) at GLY-ITC1120_0117670; Ex. 10 (Esther Castanys-Muñoz, et al., 2'-fucosyllactose: an abundant, genetically determined soluble glycan present in human milk, 773-789, NUTRITION REVIEWS 71, no. 12) at GLY-ITC1120_0117692-GLY-ITC1120_0117693; Ex. 11 (Dorothy L. Ackerman et al., Human Milk Oligosaccharides Exhibit Antimicrobial and Antibiofilm Properties against Group B Streptococcus, 595-605, AMERICAN CHEMICAL SOCIETY: INFECTIOUS DISEASES, no. 3 (2017)) at GLY-ITC1120_0117654-GLY-ITC1120_0117664.

34. So far, over 200 structurally distinct HMOs have been identified. Ex. 8 (Baumgärtner) at GLY-ITC1120_0086026; '018 Patent at 13:57-65. In the figure below, the composition of human milk is depicted to the left, with HMOs representing 10% of the composition. The pie to the right depicts various HMOs found in human milk.



The Composition of Human Milk and HMOs

35. As shown above, the most prevalent HMO is 2′-fucosyllactose, or "2′-FL." *See* Ex. 8 (Baumgärtner) at GLY-ITC1120_0086025- GLY-ITC1120_0086026; Ex. 12 (Giuseppe Puccio et al., Effects of Infant Formula With Human Milk Oligosaccharides on Growth and Morbidity: A Randomized Multicenter Trial, JPGN 64, no. 4 (April 2017) 624-631) at GLY-ITC1120_0118388; Ex. 10 (Castanys-Muñoz) at GLY-ITC1120_0117681 - GLY-ITC1120_0117681. 2′-FL is comprised of fucose, a monosaccharide, bonded to lactose, a disaccharide (galactose + glucose). *See also* Ex. 13 (Glycosyn GRAS Notice) at GLY-ITC1120_0006083. 2′-FL was first discovered in the 1950s, and first isolated into 1972. Ex. 14 (U.S. National Library of Medicine) at GLY-ITC1120_0120496. The figure below depicts 2′-FL in its chemical structure form (left) and symbolically (right).



2′-FL

36. There are four primary methods that may be used to produce HMOs: (1) deriving HMOs from its natural source (human breast milk); (2) chemical synthesis; (3) chemoenzymatic synthesis; and (4) biological synthesis. *See, e.g.*, Ex. 15 (Sandeep Ravindran, Producing Human Milk Sugars for Use in Formula) at GLY-ITC1120_0120554); ’018 Patent at 1:34-47. Until recently, however, each of these methods had major scalability issues. *See generally* ’018 Patent.

37. These scalability issues, such as extraction cost and lack of availability, made human breast milk an impractical source for commercial manufacture of HMOs. *See, e.g.*, ’018 Patent; Ex. 16 (Lars Bode, Overcoming the limited availability of human milk oligosaccharides: challenges and opportunities for research and application, 635-644, NUTRITION REVIEWS 74, no. 10 (October 2016)) at JENNEITC1120_0031294 - JENNEITC1120_0031295. Further, the difficulty in linking sugars in the correct order and orientation due to the chemistry and chirality of sugars, as well as the prohibitive cost in doing so, made chemical synthesis an unlikely source for commercial manufacture of HMOs. Ex. 3 (Nguyen) at GLY-ITC1120_0026824 - GLY-ITC1120_0026825. Chemoenzymatic synthesis has not been a viable source of commercially manufactured HMOs because, even after over 20 years of research, scientists have only been

able to use chemoenzymatic synthesis to produce HMOs on a gram scale, not a kilogram or larger scale.

38. The first successful process of producing HMOs through biological synthesis, where a microorganism is genetically engineered to produce HMOs, took nearly a decade of research to complete. *See* '018 Patent.

C. Primer on Molecular Biology

1. Genetic Principles

39. DNA is the genetic material that determines the makeup of all living cells. *See, e.g.*, Ex. 2 (Lodish) at GLY-ITC1120_0122338, GLY-ITC1120_0122347; Ex. 17 (DNA, WIKIPEDIA, https://en.wikipedia.org/ wiki/DNA), at GLY-ITC1120_0123599.[1]

40. A gene is a "basic unit of inheritance" that is "passed from parents to offspring and contains the information needed to specify physical and biological traits." Ex. 5 (https://www.genome.gov/genetics-glossary/Gene) at 2; *see also* Ex. 6 (https://dictionary.cambridge.org/us/dictionary/english/gene) at 1 (defining gene as "a part of the DNA in a cell that controls the physical development, behavior, etc. of an individual plant or animal and is passed on from its parents."); Ex. 18 (Gene, WIKIPEDIA, https://en.wikipedia.org/wiki/Gene) at GLY-ITC1120_0123664. Put another way, a gene is DNA that contains the molecular "code" for producing functional biological molecules, such as proteins. We often refer to DNA in terms of "coding sequences" but that is not meant to imply that the code is necessarily or always chemically or spatially contiguous.

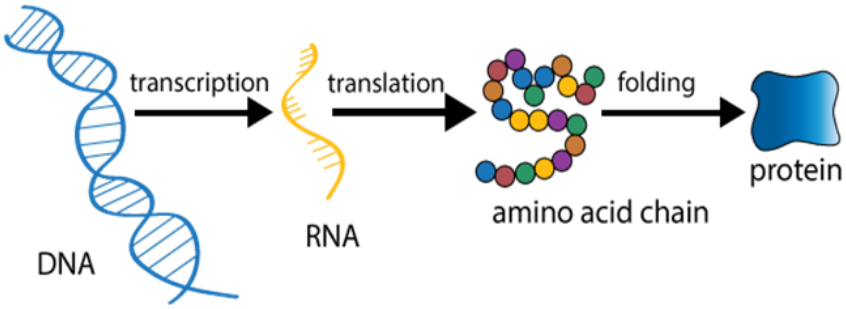
[1] Throughout this declaration, I cite to several Wikipedia pages. These Wikipedia pages are accurate and reliable because they are drawn from standard references in the field, such as molecular biology textbooks and peer-reviewed journals.

41. Proteins perform several functions in a cell, including catalyzing metabolic reactions. These catalytic proteins are called enzymes. Because of DNA's molecular "code" (also called the "genetic code"), scientists frequently state that genes "encode" polypeptides (including proteins/enzymes). Thus, to say that a gene "encodes" a working enzyme is to say that it is "involved in producing" a working enzyme.

42. Another important principle to understand about genes is that some organisms, such as eukaryotes (including mammals) have segments of DNA within protein-producing genes known as "introns." The introns do not encode the resulting functional protein and are eventually removed from the genetic material via a process known as "splicing." *See* Ex. 5 (https://www.genome.gov/genetics-glossary/Gene) at 2. The separate segments of protein-coding DNA, known as "exons," encode the functional protein and these organisms are able to produce that functional protein. *See id.*

43. Producing a protein from a gene is known as "gene expression." *See* Ex. 2 (Lodish) at GLY-ITC1120_0122347; Ex. 19 (Gene Expression, WIKIPEDIA, https://en.wikipedia.org/wiki/Gene_expression# Transcription) at GLY-ITC1120_0123690. Gene expression is fundamental to producing an observable trait—known as a "phenotype"—in any living organism. *See* Ex. 2 (Lodish) at GLY-ITC1120_0122347; Ex. 19 (Gene Expression, WIKIPEDIA, https://en.wikipedia.org/wiki/Gene_expression# Transcription) at GLY-ITC1120_0123690. To express a gene, an enzyme first produces an RNA copy of the gene's information via a process known as "transcription." Then, this RNA copy is "translated" into a chain of amino acids using a series of enzymes and structures found in the ribosome. Ex. 2 (Lodish) at GLY-ITC1120_0122354, GLY-ITC1120_0122292 - GLY-ITC1120_012230, GLY-ITC1120_0122305 - GLY-ITC1120_0122313). The resulting amino acid chain is a functional

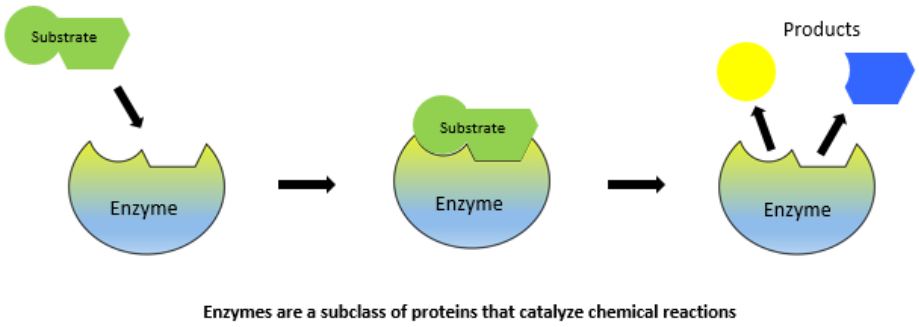
biological molecule known as a polypeptide, which then spontaneously folds into a 3-dimensional form known as a protein. In addition to catalyzing metabolic reactions, as mentioned above, proteins may also be structural or they may transport molecules from one location to another. *See* Ex. 20 (Protein, WIKIPEDIA, https://en.wikipedia.org/wiki/Protein#Cellular_functions) at GLY-ITC1120_0123749 - GLY-ITC1120_0123767. The figure below depicts the process of gene expression at a very high level.



Gene expression from DNA to protein

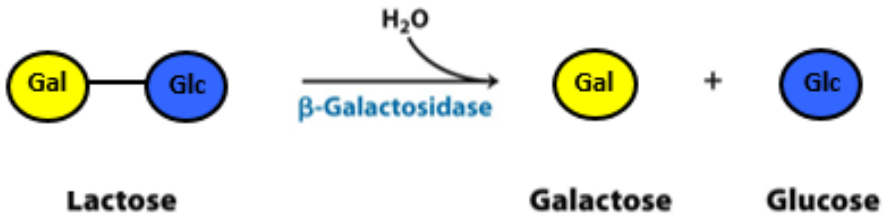
2. Enzymes

44. Enzymes are a subclass of proteins that catalyze, or speed up, chemical reactions. An enzyme usually either causes two biological molecules to come together into one piece ("put together"), or causes one biological molecule to break apart into two or more pieces ("cleave"). Ex. 2 (Lodish) at GLY-ITC1120_0122305 - GLY-ITC1120_0122313); Ex. 21 (*Enzyme*, WIKIPEDIA, https://en.wikipedia.org/wiki/Enzyme) at GLY-ITC1120_0123638, GLY-ITC1120_0123643 - GLY-ITC1120_0123644). The figure below depicts an example of an enzyme that breaks molecules apart:



Enzymes are a subclass of proteins that catalyze chemical reactions

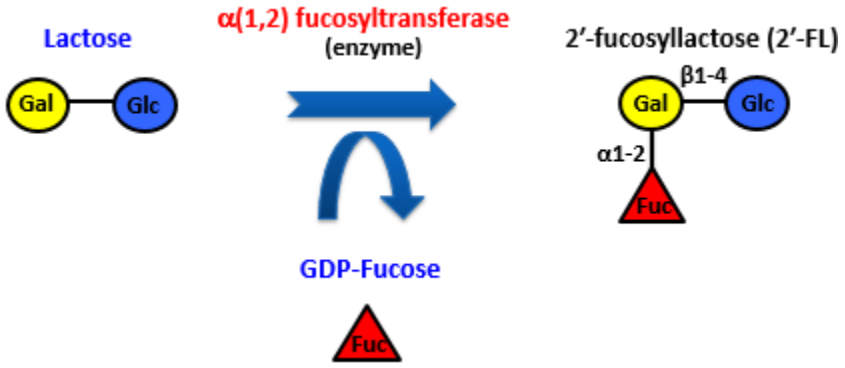
45. β-galactosidase is a well-known and well-studied enzyme that breaks molecules apart, and is featured in the '018 patent. Ex. 2 (Lodish) at GLY-ITC1120_0122498; Ex. 22 (*Beta-galactosidase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Beta-galactosidase#Properties_and_functions) at GLY-ITC1120_0122173 - GLY-ITC1120_0122175. β-galactosidase breaks down lactose into its constituent parts, galactose and glucose. Ex. 2 (Lodish) at GLY-ITC1120_0122498; Ex. 22 (*Beta-galactosidase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Beta-galactosidase#Properties_and_functions) at GLY-ITC1120_0122173 - GLY-ITC1120_0122175. The figure below depicts the reaction that β-galactosidase speeds up:



Breakdown of Lactose by β-galactosidase

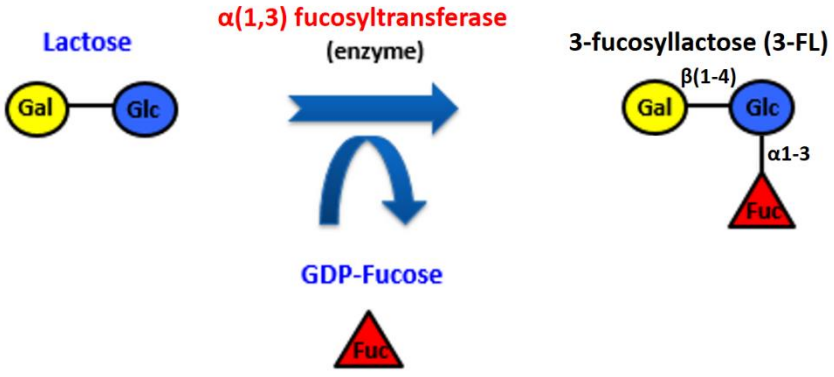
46. Fucosyltransferases are also featured in the '018 patent. In contrast to β-galactosidase, fucosyltransferases join molecules together. In particular, a fucosyltransferase

joins together a molecule of fucose with a molecule of lactose. Ex. 23 (*Fucosyltransferase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Fucosyltransferase) at GLY-ITC1120_0123652 - GLY-ITC1120_0123653. The figure below depicts a reaction forming 2′-FL using a particular fucosyltransferase.



Addition of Fucose to Lactose by a Fucosyltransferase to form 2′-FL

47. The molecule 3-fucosyllactose, or "3-FL," can be made in similar fashion, with a different fucosyltransferase. Different fucosyltransferases direct different connections of fucose to lactose, with the number (3-FL or 2′-FL) signaling the carbon molecule to which the connection is made. The figure below depicts a reaction forming 3-FL using a different fucosyltransferase than that used to make 2′-FL:



Addition of Fucose to Lactose by a Fucosyltransferase to form 3-FL

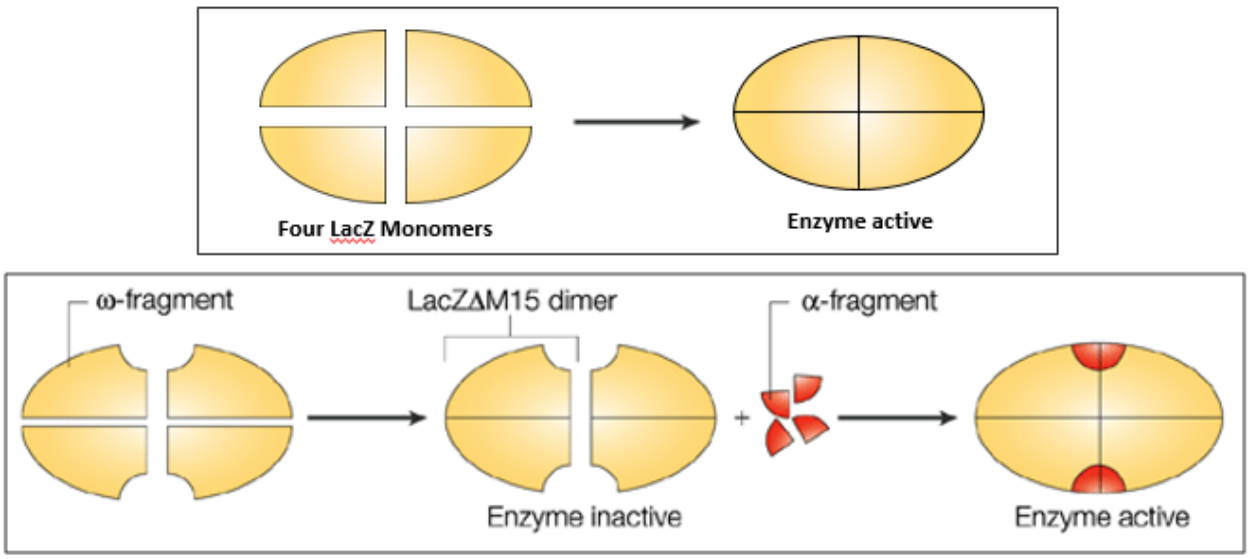
48. Enzyme activity is an important aspect of an enzyme's character, and represents the rate at which the enzyme catalyzes a particular reaction. Ex. 2 (Lodish) at GLY-ITC1120_0122306; Ex. 24 (*Enzyme Unit*, WIKIPEDIA, https://en.wikipedia.org/wiki/Enzyme_unit) at GLY-ITC1120_0123650. Enzyme activity is measured in "units"—typically, how much substrate is converted per unit of enzyme per unit time. *See* Ex. 24 (*Enzyme Unit*, WIKIPEDIA, https://en.wikipedia.org/wiki/Enzyme_unit) at GLY-ITC1120_0123650. For example, fucosyltransferase activity measures how much lactose and GDP-fucose is converted into 2′-FL per unit time, while β-galactosidase activity measures how much lactose is split into glucose and galactose per unit time. *See* Ex. 23 (*Fucosyltransferase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Fucosyltransferase) at GLY-ITC1120_0123652 - GLY-ITC1120_0123653; Ex. 22 (*Beta-galactosidase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Beta-galactosidase#Properties_and_functions), at GLY-ITC1120_0122173 - GLY-ITC1120_0122175. For any given enzyme, there may be multiple different methods (or "tests" or "assays") to measure enzyme activity.

49. As discussed above, genes encode polypeptides (including proteins/enzymes). Relevant to this case, genes known as "*lacZ*" and "*lacZα* + *lacZΩ*" are associated with the enzyme β-galactosidase.[2] Since the 1960s, scientists have known that the DNA sequence of the *lacZ* gene can be separated into two functional genes, *lacZα* and l*acZΩ*, and still produce a working β-galactosidase enzyme. The *lacZα* gene encodes for one small β-galactosidase peptide,

[2] Persons of skill in the art use the following nomenclature to distinguish between genes and the peptides they encode: genes are written in *italics* with a lowercase first letter (for example: *lacZ*, *lacZα*, *lacZΩ*), whereas peptides produced from genes are not italicized and start with a capital letter (for example: LacZ, LacZα, LacZΩ).

while the *lacZΩ* gene encodes for the other, larger β-galactosidase peptide. When both peptides are present in an organism, they spontaneously assemble into a full-length peptide, which automatically folds into one subunit of a working β-galactosidase enzyme. Ex. 22 (*Beta-galactosidase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Beta-galactosidase#Properties_and_functions) at GLY-ITC1120_0122175. This is known as "alpha complementation," and it is a powerful genetic engineering technique.

50. The active β-galactosidase enzyme is a "homotetramer," which means that it is made out of four identical monomers, or subunits. Four LacZ polypeptide monomers automatically assemble into an active β-galactosidase enzyme. I have created the following figure to illustrate the monomers of β-galactosidase and alpha complementation:



Alpha Complementation in the β-galactosidase Homotetramer

The top portion of the figure shows four β-galactosidase monomers, each of which represents one polypeptide transcribed and translated from the *lacZ* gene, and the spontaneous assembly of

the homotetramer β-galactosidase enzyme. The bottom portion of the figure shows how the LacZα polypeptide complements the LacZΩ polypeptide to create an active β-galactosidase enzyme. *See* Ex. 22 (*Beta-galactosidase*, WIKIPEDIA, https://en.wikipedia.org/wiki/Beta-galactosidase#Properties_and_functions) at GLY-ITC1120_0122175.

3. Bioengineering Microorganisms

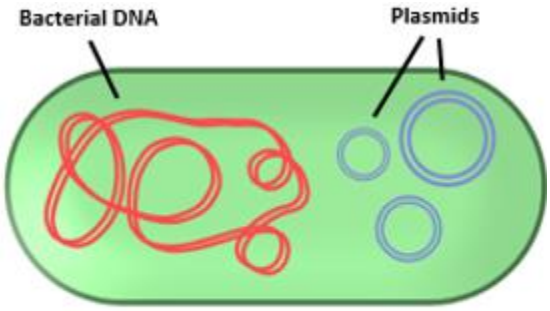
51. Bioengineering a microorganism to produce something it does not naturally produce requires the addition, deletion, and/or modification of the microorganism's genes. Ex. 25 (*Biological Engineering*, WIKIPEDIA, https://en.wikipedia.org/wiki/ Biological_engineering) at GLY-ITC1120_0123594 - GLY-ITC1120_0123598. The bacterial genome is much simpler than the human genome, which consists of 23 pairs of chromosomes. *See* Ex. 26 (*Prokaryote*, WIKIPEDIA, https://en.wikipedia.org/wiki/Prokaryote) at GLY-ITC1120_0123738, GLY-ITC1120_0123743 - GLY-ITC1120_0123744; Ex. 2 (Lodish) at GLY-ITC1120_0122492. Bacterial DNA consists of a single circular chromosome plus smaller circular DNA called plasmids. *See* Ex. 27 (*Plasmid*, WIKIPEDIA, https://en.wikipedia.org/wiki/Plasmid) at GLY-ITC1120_0123728; Ex. 2 (Lodish) at GLY-ITC1120_0122229 – GLY-ITC1120_0122230. The DNA of an *E. coli* bacterium consists of a long circular strand of chromosomal DNA, and in many cases also smaller circular plasmid DNAs.

52. To bioengineer a microorganism to exhibit a certain phenotype, or trait, DNA consisting of a gene or genes from another source is incorporated into a bacterium's chromosomal DNA or into a plasmid. Ex. 28 (*Molecular Cloning*, WIKIPEDIA, https://en.wikipedia.org / wiki/ Molecular_cloning) at GLY-ITC1120_0123715; Ex. 2 (Lodish) at GLY-ITC1120_0122421. Once the foreign gene(s) are incorporated, the bacterium is able to express the new gene(s), which can lead to a different phenotype. *See* Ex. 2 (Lodish) at GLY-

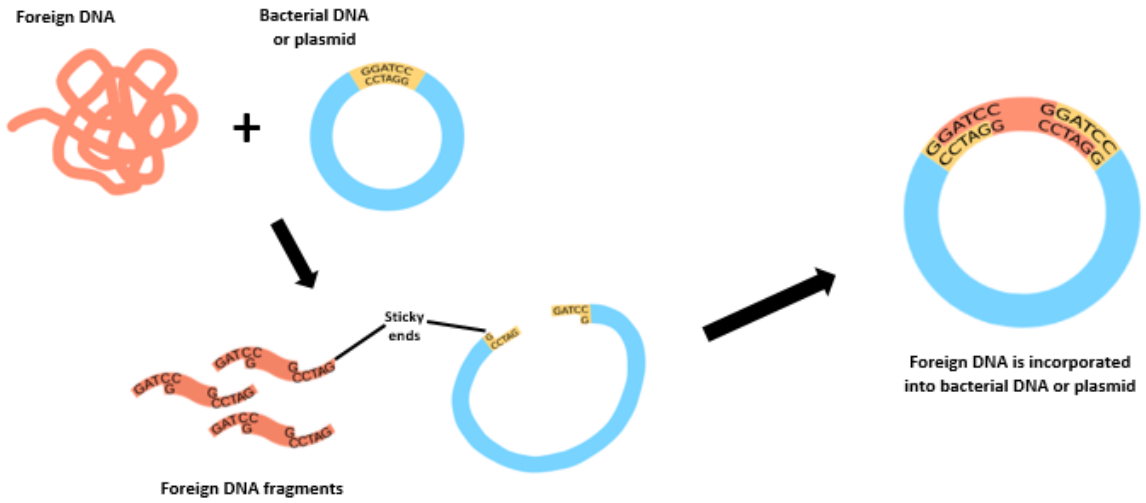
ITC1120_0122421 - GLY-ITC1120_0122422; Ex. 29 (*Recombinant DNA*, WIKIPEDIA, https://en.wikipedia.org/ wiki/Recombinant _DNA#Properties_of_organisms_containing_recombinant_DNA), at GLY-ITC1120_023779.

53. There are several methods of genetic engineering. For example, one method involves isolating the gene(s) to be transferred from the foreign DNA, and then inserting the gene(s) either randomly or into a targeted location in the host organism's DNA. Ex. 2 (Lodish) at GLY-ITC1120_0122421 - GLY-ITC1120_0122422. When the foreign DNA is sliced in a manner that leaves an overhanging piece of single-stranded DNA, these "sticky ends" can automatically connect with other pieces of DNA that have complementary sticky ends. In the figure below, the bacterial genome of an *E. coli* bacterium is depicted on top; its DNA consists of a long circular strand of chromosomal DNA, and in many cases also smaller circular DNA called plasmids. The bottom of the figure depicts the integration of foreign DNA into bacterial DNA via "sticky ends."

54.



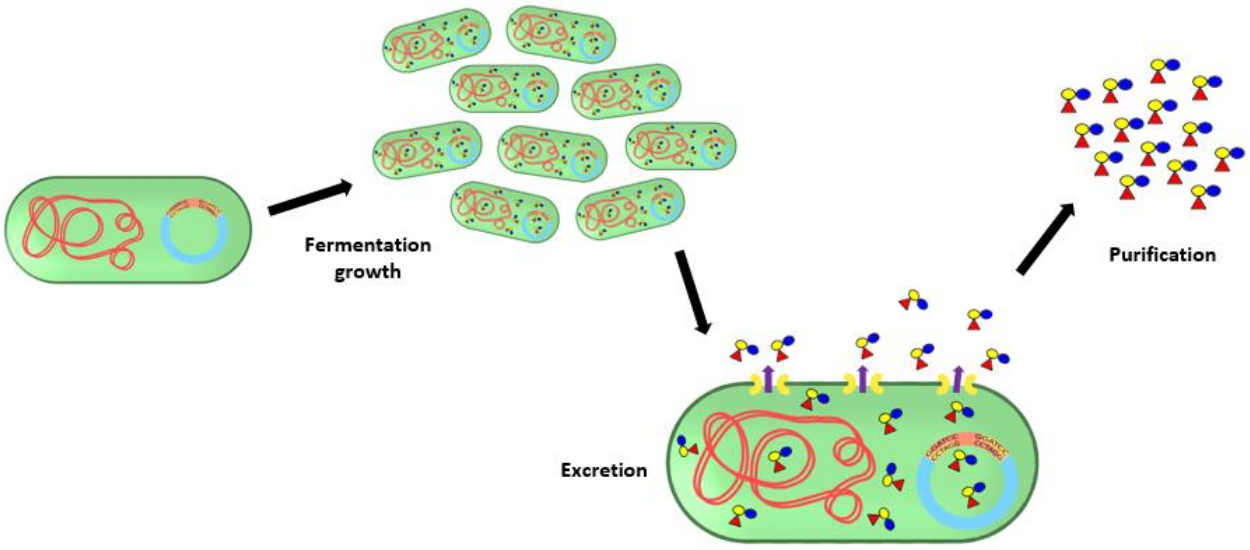
Bacterial Genome



55. Another method of bioengineering microorganisms includes inactivating a gene that is already carried within the bacteria's DNA. *See* Ex. 2 (Lodish) at GLY-ITC1120_0122252; Ex. 28 (*Molecular Cloning*, WIKIPEDIA, https://en.wikipedia.org/wiki/Molecular_cloning#Preparation_of_vector_DNA) at GLY-ITC1120_0123720 - GLY-ITC1120_0123721. Once the gene is inactivated, the bacteria becomes unable to express the polypeptide encoded by the gene, typically resulting in a different phenotype. Ex. 2 (Lodish) at GLY-ITC1120_0122252; Ex. 28 (*Molecular Cloning*, WIKIPEDIA, https://en.wikipedia.org/wiki/Molecular_cloning# Preparation_of_vector_ DNA) at GLY-ITC1120_0123720 - GLY-ITC1120_0123721. For example, if a gene involved in the synthesis of colanic acid, such as *wcaJ*, is inactivated in a bacterium, the bacterium will likely no longer be able to produce colanic acid. When a genetic modification is successfully made to a cell, all offspring from that cell will contain the same genetic modification. *See* Ex. 28 (*Molecular Cloning*, WIKIPEDIA, https://en.wikipedia.org/wiki/ Molecular_cloning #Screening_for_clones_with_desired_DNA_inserts _ and _ biological_properties) at GLY-ITC1120_0123720.

56. When the bioengineering process is complete, the resultant bacteria will have a certain phenotype, in this case, the production of 2′-FL or 3-FL. *See* Ex. 28 (*Molecular Cloning*, WIKIPEDIA, https://en.wikipedia.org/wiki/Molecular_cloning #Production_of_recombinant_proteins) at GLY-ITC1120_0123715 - GLY-ITC1120_0123723. The bacteria are then cultured in a process called fermentation. Ex. 30 (*Industrial Fermentation*, WIKIPEDIA, https://en.wikipedia.org/wiki/Industrial_fermentation#Fermentation_medium) at GLY-ITC1120_0123709 - GLY-ITC1120_0123714. The name of this process derives from the word "ferment," because growing bacteria can consume sugar in the absence of oxygen—but modern fermentation more broadly describes the process by which bacterial cells are grown with or without oxygen and used for biological and chemical engineering purposes.

57. In the fermentation process relevant to this case, as the *E. coli* bacteria reproduce and multiply, each cell produces a fucosylated oligosaccharide product (such as 2′-FL or 3-FL), and then excretes the product into the culture liquid. Ex. 31 (*Protein Purification*, WIKIPEDIA, https://en.wikipedia.org/ wiki/Protein_purification#Preliminary_steps) at GLY-ITC1120_0123768 - GLY-ITC1120_0123770. The fermentation/culture liquid is known as "medium/media" or "broth." After fermentation concludes, bacterial cells are removed from the culture media and the resulting oligosaccharide is purified. The figure below depicts the culturing process on a high level, for the oligosaccharide 2′-FL:



Growth, Excretion, and Purification of Bacteria Producing 2′-FL

VIII. OPINIONS REGARDING THE DISPUTED CLAIM TERMS

58. I understand that there are five terms being construed in this litigation, and that Glycosyn and Counterclaim-Defendants have agreed to the construction of three of those terms: "**wild-type**," "**colanic acid synthesis gene**," and "***E. coli* lacZ gene**." That leaves two claims in dispute: "**[an] exogenous functional β-galactosidase gene**" and "**the level of β-galactosidase activity comprises between 0.05 and [200 units / 5 units /4 units / 3 units/ 2 units]**." I understand the parties' positions to be as stated in the Joint Claim Construction and Prehearing Statement, attached here as Appendix B. For ease of reference, I have copied below the chart showing the disputed claim terms and the parties' respective proposed constructions:

TERM	GLYCOSYN'S CONSTRUCTION	CHR. HANSEN & ABBOTT'S CONSTRUCTION	COURT'S CONSTRUCTION
"the level of β-galactosidase activity comprises between 0.05 and [200 units / 5 units / 4 units / 3 units / 2 units]" ('018 patent claims 1, 18, 25-28)	Not indefinite; [1] "when a culture of the *E. Coli* bacteria comprising the exogenous functional β-galactosidase gene is assayed using the Miller protocol, β-galactosidase activity is measurable at between exactly 0.05 and exactly [200/5/4/3/2] Miller Units, as defined in Miller, J.H., Experiments in Molecular Genetics. Cold Spring Harbor Laboratory (Cold Spring Harbor, N.Y.; 1972) at 352-355"	Indefinite; "β-galactosidase activity is measurable at between exactly 0.05 and exactly [200/5/4/3/2] Miller Units, as defined in Miller, J.H., Experiments in Molecular Genetics (Cold Spring Harbor Lab. 1972) at 352-355, where the β-galactosidase activity is the β-galactosidase activity attributable to the expression of the exogenous functional β-galactosidase gene only"	
"[an] exogenous functional β-galactosidase gene"	Plain and ordinary meaning, *i.e.*, "contiguous or non-contiguous DNA originating outside the *E. coli* bacterium	"a single functional sequence of DNA, originating outside the *E. coli* bacterium, that encodes a	

A. "the level of β-galactosidase activity comprises between 0.05 and [200 units / 5 units /4 units / 3 units/ 2 units]"

59. As an initial matter, I note that Counterclaim Defendants have alleged that this term is indefinite. While I do not agree that this term is indefinite, I have been informed by counsel that the Court will reserve any arguments as to indefiniteness for summary judgment. Thus, I will reserve any rebuttal to Counterclaim Defendants' indefiniteness arguments at that stage of the case. With this caveat, I will address the parties' competing constructions as outlined in the Joint Claim Construction Chart.

60. The "activity" of an enzyme is a measure of the enzyme's ability to convert a certain amount of "substrate" per unit time. The "substrate" refers to the molecule or molecules that are acted upon by enzyme. In the case of β-galactosidase enzyme, for example, lactose is the substrate.

61. Enzyme activity is typically measured via an enzyme "assay." Assays allow scientists to measure either quantitatively or qualitatively an enzyme activity level in an organism, or in a sample obtained from that organism.

62. When higher quantities of "active" enzyme are present, the organism's ability to convert substrate per unit time (or the rate of the conversion) is greater. When lower quantities of active enzyme are present, the organism's ability to convert substrate per unit time is lessened. If there is a lot of enzyme present in a sample but the enzyme is not "active" (for example, because it is denatured or misfolded or contaminated in some way), the rate of conversion will also be reduced.

63. A person of ordinary skill in the art at the time of the '018 invention would, upon reading the specification and claims, immediately ascertain that the claim term "units" refers to "Miller units." Miller units are determined by an assay described in Miller, *Experiments in Molecular Genetics* (1972), the very same reference that is recited in column 7, lines 34-37 of the '018 patent ("for unit definition see …"). *See* Ex. 32 (Miller, J.H., Experiments in Molecular Genetics (Cold Spring Harbor Lab. 1972) at 352-355).

64. The Miller assay is a well-known assay for quantitatively measuring the activity of β-galactosidase. Miller assays are conducted in laboratories across the world to this day. I have conducted the Miller assay many times, as have my students. Any person of ordinary skill in the art at the time of the invention would not only be familiar with the Miller assay, but also would be able to follow its methodology, which is clearly described in Miller's 1972 textbook.

65. A person of ordinary skill in the art at the time of the invention would understand how to apply the Miller assay to a particular bacterial system. For example, few scientists would have reason to use the particular bacterial strain used in Miller's 1972 protocol (because they

would be using a differently engineered strain), but they would still know how to apply Miller's protocol to their new strain.

66. I do not agree with Counterclaim Defendants' proposed construction of the above term, which adds the following functional limitation to it: *"... where the β-galactosidase activity is the β-galactosidase activity attributable to the expression of the exogenous functional β-galactosidase gene only." See* Joint Claim Construction Chart (Abbott/Chr. Hansen proposed construction). In my view, there is nothing in the '018 patent or the incorporated-by-reference Miller textbook that supports this reading of the claim.

67. By its very design, the Miller assay measures β-galactosidase activity in a bacterium or other system. It reports a result in "units." The Miller assay incorporates so-called "negative controls" in order to ensure the accuracy of the result, and to make sure that β-galactosidase activity is not being over-reported. The Miller assay does not, however, discuss which portion of the result is "attributable" to which genes, or to which genes "only." In my view, Counterclaim Defendants' have inserted words into the construction that have little to do with the science of the Miller assay and are entirely unnecessary for a person of ordinary skill in the art to understand the claim term as written. Accordingly, based on my understanding of claim construction principles, the Court should reject such a needless insertion.

B. "[an] exogenous functional β-galactosidase gene"

68. I previously offered my opinion regarding the proper construction of a similar term, "functional . . . β-galactosidase gene," before the International Trade Commission (ITC) in Investigation No. 337-TA-1120. At the ITC, I agreed with Glycosyn's construction of "plain and ordinary meaning, *i.e.*, a gene involved in producing a working β-galactosidase enzyme." *See Certain Hum. Milk Oligosaccharides & Methods of Producing the Same*, Inv. No. 337-TA-

1120, 2018 WL 6837945, at *18 (U.S.I.T.C. Dec. 18, 2018) (Order No. 22: Construing the Terms of the Asserted Claims of the Patents at Issue).

69. In this proceeding, Glycosyn proposes that "[an] exogenous functional β-galactosidase gene" also be accorded its plain and ordinary meaning, which in this context means "contiguous or non-contiguous DNA originating outside the *E. coli* bacterium that encodes for a working β-galactosidase enzyme.'" It is my opinion that Glycosyn's proposed construction in this litigation is entirely consistent with its proposed construction for the similar term at the ITC. Glycosyn's addition of the phrase "contiguous or non-contiguous DNA" is only necessary for rebutting Counterclaim Defendants' addition of the phrase "single functional sequence of DNA," as I explain below.

70. As I understand the parties' positions in the Joint Claim Construction Chart above, Counterclaim Defendants are proposing that the claim term ***not*** be accorded its plain and ordinary meaning, but instead be defined as: *"a single functional sequence of DNA, originating outside the E. Coli bacterium, that encodes a working β-galactosidase enzyme." See* Joint Claim Construction Chart (Abbott/Chr. Hansen proposed construction). I do not agree with this proposed construction.

71. As an initial matter, I do not see where the patentee expressly limited the definition of "gene" to "a single functional sequence of DNA." I do not see those words anywhere in the specification of the '018 patent or its prosecution history.

72. Moreover, I do not believe that Counterclaim Defendants' proposed construction aligns with how a person of ordinary skill in the art would have understood the claim term at the time of the invention.

73. As I explain in the scientific background section above, a gene is a sequence of DNA that contains the molecular "code" for producing functional biological molecules, such as proteins. Enzymes are simply a class of proteins that catalyze reactions in organisms (as opposed to classes of proteins with other functions, such as structural proteins). Because of DNA's molecular "code," scientists frequently state that genes "encode" polypeptides (including proteins/enzymes). Thus, to say that a gene "encodes" a working enzyme is to say that it is "involved in producing" a working enzyme.

74. β-Galactosidase is a well-known and well-studied enzyme. It functions by cleaving the glycosidic bond in lactose, thus breaking the molecule into its monosaccharide components of galactose and glucose. In *E. coli*, the gene that encodes for the β-galactosidase enzyme is the *lacZ* gene. As discussed above, the DNA sequence of the *lacZ* gene can be separated into two functional genes, *lacZα* and l*acZΩ*, and still produce a working β-galactosidase enzyme. The *lacZ*α gene encodes for one small β-galactosidase peptide, while the *lacZΩ* gene encodes for the other larger β-galactosidase peptide. When both peptides are present in an organism, they spontaneously assemble into a full-length peptide, which automatically folds into one subunit of a working β-galactosidase enzyme.

75. A person of ordinary skill in the art at the time of the invention would understand that they may take advantage of the aforementioned characteristic of the β-galactosidase enzyme with a technique called α-complementation, which was first demonstrated in 1967 by Agnes Ullmann in the laboratory of François Jacob and Jacques Monod. If the *lacZα* gene is deleted, the *lacZΩ* gene produces a β-galactosidase enzyme that is not functional. However, if the *lacZα* gene is reintroduced somewhere else in the genome (for example via a plasmid), then the functionality of β-galactosidase is fully restored—hence the term "α-complementation."

76. β-galactosidase α-complementation remains a useful genetic engineering technique for determining whether an engineered plasmid has been successfully inserted into a bacterium, and it was extremely well-known at the time of the '018 invention. Thus, a person of ordinary skill in the art at the time of the '018 invention would have known that for a bacterium to create a working β-galactosidase enzyme, the cell ***does not need*** (and commonly does not have) a ***single***, full-length *lacZ* gene. Rather, the cell may just as readily have a *lacZα* gene and a *lacZΩ* gene, which when expressed together create a working β-galactosidase enzyme.

77. Moreover, even a full-length *lacZ* gene, when transcribed into a single polypeptide, does not produce a functional β-galactosidase enzyme. As I discuss in the background section above, a "full-length *lacZ* gene" encodes for a monomer subunit of the β-galactosidase enzyme. A functional β-galactosidase enzyme requires the assembly of four such monomers.

78. A person of ordinary skill in the art at the time of the '018 invention would therefore have understood that a bacterial genome has a "functional sequence of DNA that encodes β-galactosidase" whether that functional DNA sequence is present in one place (a single, full-length *lacZ* gene) or two (the *lacZα* and *lacZΩ* fragments), and regardless of where the DNA sequences may be placed.

79. A person of ordinary skill in the art would have understood for additional reasons that a "gene" is not comprised of a "single … sequence" of DNA. For example, as I discuss in the scientific background section above, organisms that have introns produce working proteins despite having non-contiguous DNA. *See* Ex. 5 (https://www.genome.gov/genetics-glossary/Gene) at 2. Indeed, in the case of eukaryotic organisms, "introns" of DNA interrupt the

"single … sequence" of virtually every gene without altering expression of the "functional" protein (or enzyme) encoded by the gene.

80. In sum, I believe that Counterclaim Defendant's proposed construction of "[an] exogenous functional β-galactosidase gene" inserts an improper and scientifically incorrect limitation into the claim term, without any express basis in the '018 patent. I do not believe any construction of the claim term is necessary, as plain and ordinary meaning should control. But in the event that the Court wishes to impose a construction of the term, the construction should make clear that the referenced "gene" can come from "***contiguous or non-contiguous DNA***" (as Glycosyn proposes), not a "single functional sequence of DNA" (as Counterclaim Defendants' propose).

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct to the best of my knowledge and belief.

Executed on August 24, 2023

Dr. Kristala L. Jones Prather

Appendix A

Curriculum Vitae

Kristala L. J. Prather

Work Address: Department of Chemical Engineering
Massachusetts Institute of Technology
77 Massachusetts Ave, Room E17-504G

Tel: (617) 253-1950
Email: kljp@mit.edu
Web: prathergroup.mit.edu

Education

Ph.D. Chemical Engineering, University of California, Berkeley, Dec 1999
Dissertation: "Development of Low-Copy Expression Vectors Derived from the F Plasmid of *Escherichia coli*"
Research Advisor: Jay D. Keasling

S.B. Chemical Engineering, Massachusetts Institute of Technology, May 1994

Experience

9/2004 – present: **Massachusetts Institute of Technology, Cambridge, MA**
Dept of Chemical Engineering,
Executive Officer (2/2020 – 6/2023)
Arthur D. Little Professor (7/2017 – present)
Associate Professor with Tenure (7/2013 – 6/2017)
Associate Professor without Tenure (7/2011 – 6/2013)
Assistant Professor (9/2004 – 6/2011)
Courses taught: Introduction to Chemical Engineering; Integrated Chemical Engineering/Introduction to Biocatalysis; Biochemical Engineering, Chemical-Biological Engineering Laboratory.

4/2000 – 7/2004: **Merck Research Labs, Merck & Co., Inc. Rahway, NJ**
Bioprocess Research & Development,
Research Fellow (12/2003 – 7/2004)
Senior Research Biochemical Engineer (4/2000-11/2003)
Characterization of seed selection for recombinant process; development and characterization of stably transfected cell cultures; development of recombinant biocatalysis libraries. Supervised two full-time associate staff, one contingency employee, and three interns (over four summers). Delivered guest lectures in Biochemical Engineering course at Columbia University.

8/1994 – 12/1999: **University of California. Berkeley, CA**
Graduate Student/Research Assistant, Dept of Chemical Engineering
Studied physiology of recombinant *E. coli* expression systems, with emphasis on plasmid-based expression for metabolic engineering applications.

1/1999 – 5/1999: **University of California. Berkeley, CA**
Graduate Student Instructor, Dept of Chemical Engineering
Biochemical Engineering Laboratory (ChE 170L). Taught all laboratory sections, graded laboratory reports, redesigned major portions of course curriculum.

6/1998 – 9/1998: **E.I. duPont de Nemours and Co. Wilmington, DE**
Graduate Intern, DuPont Life Sciences, Biochemical Science and Engineering/Bioprocess Development Center
Constructed and investigated recombinant *E. coli* strain for improved co-factor recycling, thereby enhancing productivity of reduced product.

8/1996 – 12/1996: **University of California. Berkeley, CA**
Graduate Student Instructor, Dept of Chemical Engineering
Biochemical Engineering (ChE 170). Taught two discussion sections, prepared and graded exam problems, lectured for one-week during instructor's absence.

1/1996 – 5/1996: **University of California. Berkeley, CA**
Graduate Student Instructor, Dept of Chemical Engineering
Chemical Process Design (ChE 160). Held regular meetings with project groups, evaluated evolving process designs.

6/1994 – 8/1994: **Exxon Production Research Company. Houston, TX**
Summer Intern.

9/1993 – 5/1994: **MIT, Undergraduate Research Opportunities Program. Cambridge, MA**
Mathematical modeling and data analysis of substrate pulse addition in fermentation. Model tested for non-growth associated experiments.

2/1992 – 5/1994: **MIT, Graduate School Office. Cambridge, MA**
Student office assistant.

6/1993 – 8/1993: **Rohm & Haas Texas, Inc. Deer Park, TX**
Summer Engineer.

6/1992 – 8/1992: **Merck Manufacturing Division, Merck & Co., Inc. West Point, PA**
Summer Intern, Biological Process Engineering.

10/1990 – 5/1992: **MIT, Office of Minority Education. Cambridge, MA**
Student coordinator of Secrets and Strategies for Academic Success (SSAS) seminar series.

6/1991 – 8/1991: **Texas Eastman Company. Longview, TX**
Engineer's Assistant.

Honors and Awards

William A. Lester Lecture, College of Chemistry, University of California, Berkeley (2023)
Andreas Acrivos Award for Professional Progress in Chemical Engineering, AIChE (2021)
Fredrickson Lecture, Department of Chemical Engineering and Materials Science, University of Minnesota (2021)
Gordon Y. Billard Award, MIT (2021)
Fellow, American Institute for Medical and Biological Engineering (AIMBE) (2020)
Fellow, American Institute of Chemical Engineers (AIChE) (2020)
Fellow, American Association for the Advancement of Science (AAAS) (2018)

Charles Thom Award of the Society for Industrial Microbiology and Biotechnology (2017)
C. Michael Mohr Outstanding Faculty Award for Undergraduate Teaching, Dept. of Chemical Engineering, MIT (2016)
Martin H. Freeman Lecture (inaugural lecture), Middlebury College, Middlebury, VT (2016)
Lloyd N. Ferguson Lecture, California State University Los Angeles (2015)
Merck Lectureship in Chemical Engineering, University of Virginia (2014)
Dr. Bruce J. Nelson '74 Distinguished Speaker Series, Harvey Mudd College (2014)
Fellow, Radcliffe Institute for Advanced Study (2014-2015)
MIT MacVicar Faculty Fellow (2014)
Third Indonesian-American Kavli Frontiers of Science Symposium speaker/Kavli Fellow (2013)
Van Ness Lectureship, Rensselaer Polytechnic Institute (2012)
Young Scientist, World Economic Forum Annual Meeting of the New Champions (2012)
Biochemical Engineering Journal Young Investigator Award (2011)
MIT School of Engineering Junior Bose Award for Excellence in Teaching (2010)
National Academy of Sciences Kavli Frontiers of Science Symposium speaker/Kavli Fellow (2010)
National Science Foundation CAREER Award (2010)
Technology Review "TR35" Young Innovator (2007)
C. Michael Mohr Outstanding Faculty Award for Undergraduate Teaching, Dept. of Chemical Engineering, MIT (2006)
Office of Naval Research Young Investigator Award (2005-2008)
Camille and Henry Dreyfus Foundation New Faculty Award (2004)
Ford Foundation Dissertation Fellowship (1998)
UNCF-Merck Science Initiative Graduate Fellowship (1996-1998)
NOBCChE/DuPont Graduate Fellowship Award (1996-1997)
National Defense Science and Engineering Graduate (NDSEG) Fellowship (1994-1997)
Robert T. Haslam Cup for professional promise in chemical engineering (MIT 1994)
Karl Taylor Compton Prize (MIT 1994)
National Society of Black Engineers (NSBE) Distinguished Fellow (1994)
Ronald E. McNair/Black Alumni at MIT Scholarship Award (1993)
National Science Foundation Scholarship (1993)
Tau Beta Pi National Honor Society

Publications

1. Jones, K.L. and J. D. Keasling. 1998. "Construction and characterization of F plasmid-based expression vectors." *Biotechnol. Bioeng.* **59:**659-665. PMID:10099385.

2. Carrier, T.A., K.L. Jones, and J. D. Keasling. 1998. "mRNA stability and plasmid copy number effects on gene expression from an inducible promoter system." *Biotechnol. Bioeng.* **59:**666-672. PMID:11948448.

3. Jones, K.L., S.-W. Kim, and J.D. Keasling. 2000. "Low-copy plasmids can perform as well as or better than high-copy plasmids for metabolic engineering of bacteria." *Metabolic Engineering.* **2:**328-338. PMID:11120644.

4. Aldor, I.S., S.-W. Kim, K.L.J. Prather, and J.D. Keasling. 2002. "Metabolic engineering of a novel propionate-independent pathway for the production of poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) in recombinant *Salmonella enterica* serovar Typhimurium." *Appl. Envir. Microbiol.* **68:**3848-3854.

5. Prather, K. J., S. Sagar, J. Murphy, and M. Chartrain. 2003. "Industrial scale production of plasmid DNA for vaccine and gene therapy: plasmid design, production, and purification." *Enzyme Microb. Technol.* **33:**865-883.

6. Montgomery, D. L., and K.J. Prather. 2006. "Design of plasmid DNA constructs for vaccines." in DNA Vaccines, 2nd ed. Humana Press.

7. Prather, K.L.J., M.C. Edmonds, and J.W. Herod. 2006. "Identification and characterization of IS1 transposition in plasmid amplification mutants of *E. coli* clones producing DNA vaccines." *Appl. Microbiol. Biotechnol.* **73**:815-826. PMID:19205691.

8. Prather, K.L.J. and C.H. Martin. 2008. "*De novo* biosynthetic pathways: rational design of microbial chemical factories." *Curr. Opin. Biotechnol*. **19(5)**:468-474.

9. Leonard, E., D.R. Nielsen, K.V. Solomon, and K.L.J. Prather. 2008. "Engineering microbes with synthetic biology frameworks." *Trends Biotechnol.* **26(12)**:674-681.

10. Rodrigo, G., J. Carrera, K.L.J. Prather, and A. Jaramillo. 2008. "DESHARKY: Automated design of metabolic pathways for optimal cell growth*." Bioinformatics.* **24(21)**:2554-2556.

11. Nielsen, D.R., and K.L.J. Prather. 2009. "In situ product recovery of n-butanol using polymeric resins." *Biotechnol. Bioeng*. **102(3)**:811-821.

12. Martin, C.H and K.L.J. Prather. 2009. "High-titer production of monomeric hydroxyvalerates from levulinic acid in *Pseudomonas putida*." *J. Biotechnol.* **139(1)**:61-67.

13. Moon, T.S., S.-H. Yoon, A.M. Lanza, J.D. Roy-Mayhew, and K.L.J. Prather. 2009. *"*Production of glucaric acid from a synthetic pathway in recombinant *Escherichia coli.*" *Appl. Environ. Microbiol.* **75(3)**:589-595. DOI: 10.1128/AEM.00973-08. PMID:19060162.

14. Yoon, S.-H., T.S. Moon, P. Iranpour, A.M. Lanza, and K.J. Prather 2009. "Cloning and characterization of uronate dehydrogenases from two Pseudomonads and *Agrobacterium tumefaciens* str. C58." *J. Bacteriol*. **191(5)**:1565-1573. PMID:3949717.

15. Bower, D.M, and K.L.J. Prather. 2009. "Engineering of bacterial strains and vectors for the production of plasmid DNA." *Appl. Microbiol. Biotechnol.* **82(5)**:805-813.

16. Martin, C.H., D. R. Nielsen, K.V. Solomon, and K.L.J. Prather. 2009. "Synthetic metabolism: engineering biology at the protein and pathway scales." *Chem. Biol.* **16(3)**:277-286.

17. Leonard, E., W. Runguphan, S. O'Connor, and K.J. Prather. 2009. "Opportunities in metabolic engineering to enable scalable alkaloid production." *Nature Chem. Biol*. **5(5)**:292-300.

18. Tseng, H.-C., C. Martin, D.R. Nielsen, and K.L.J. Prather. 2009. "Metabolic engineering of *Escherichia coli* for the enhanced production of (R)- and (S)-3-hydroxybutyrate." *Appl. Environ. Microbiol*. **75(10)**:3137-3145. DOI: 10.1128/AEM.02667-08. PMID:19304817.

19. Nielsen, D.R., E. Leonard, S.-H. Yoon, H.-C. Tseng, C. Yuan, and K.J. Prather. 2009. "Engineering alternative butanol production platforms in heterologous bacteria." *Metab. Eng.* **11**:262-273. DOI: 10.1016/j.ymben.2009.05.003. PMID:19464384.

20. Moon, T.S., S.-H. Yoon, M.-J. Tsang Mui Ching, A.M. Lanza, and K.L.J. Prather. 2009. "Enzymatic assay of D-glucuronic acid using uronate dehydrogenase." *Analytical Biochemistry*. **392(2)**:183-185.

21. Oliveira, P.H., K. J. Prather, D. M. Prazeres, and G. Monteiro. 2009. "Structural instability of plasmid biopharmaceuticals: challenges and implications." *Trends Biotechnol*. **27(9)**:503-511.

22. Dueber, J.E., G.C. Wu, G. R. Malmirchegini, T.S. Moon, C.J. Petzold, A.V. Ullal, K.L.J. Prather, J.D. Keasling. 2009. "Synthetic protein scaffolds provide modular control over metabolic flux." *Nature Biotechnol.* **27(8)**:753-759.

23. K.L.J Prather. 2010. "Low copy number plasmids as artificial chromosomes," in The Metabolic Pathway Engineering Handbook: Tools and Applications, CRC Press.

24. Jeng, E.S., J. D. Nelson, K. L. J. Prather, and M. S. Strano. 2010. "Detection of a single nucleotide polymorphism using single-walled carbon-nanotube near-infrared fluorescence." *Small*. **6(1)**:40-43.

25. Martin, C.H., D. Wu, and K.L.J. Prather. 2010. "Integrated bioprocessing for the pH-dependent production of 4-valerolactone from levulinate in *Pseudomonas putida* KT2440." *Appl. Environ. Microbiol.* **76(2)**:417-424.

26. Nielsen, D.R., G.S. Amarasiriwardena, and K.L.J. Prather. 2010. "Predicting the adsorption of second generation biofuels by polymeric resins with applications for *in situ* product recovery (ISPR)." *Bioresource Technol*. **101**:2762-2769.

27. Nielsen, D.R., S.-H. Yoon, C. J. Yuan, and K.L.J. Prather. 2010. "Metabolic engineering of acetoin and *meso*-2, 3-butanediol biosynthesis in *E. coli*." *Biotechnol. J.* **5**:274-284.

28. Moon, T.S., J. E. Dueber, E. Shiue and K. L. J. Prather. 2010. "Use of modular, synthetic scaffolds for improved production of glucaric acid in engineered *E. coli*." *Metab. Eng.* **12**:298-305. PMID:20117231.

29. Oliveira, P.H., K. J. Prather, D. M. F. Prazeres, and G. A. Monteiro. 2010. "Analysis of DNA repeats in bacterial plasmids reveals the potential for recurrent instability events." *Appl. Microbiol. Biotechnol.* **87**:2157–2167.

30. Fischer, C.R., H.-C. Tseng, M. Tai, K.L.J. Prather, G. Stephanopoulos. 2010. "Assessment of heterologous butyrate and butanol pathway activity by measurement of intracellular pathway intermediates in recombinant *Escherichia coli*." *Appl. Microbiol. Biotechnol*. **88(1)**:265-275.

31. Leonard, E., P. Ajikumar, K. Thayer, W.-H. Xia, J.D. Mo, B. Tidor, G. Stephanopoulos, K.L.J. Prather. 2010. "Combining metabolic and protein engineering of a terpenoid biosynthetic pathway for overproduction and selectivity control." *Proc. Nat. Acad. Sci. USA.* **107(31)**:13654-13659.

32. Prather, K.J., McLamore, E.S., Porterfield, D.M. 2010. "Synthetic biology and the rational design of microbial chemical factories." *Gravit. and Space Biol. Bull*. **23**:49-54.

33. Tseng, H.-C., C. L. Harwell, C. H. Martin, K. L. J. Prather. 2010. "Biosynthesis of chiral 3-hydroxyvalerate from single propionate-unrelated carbon sources in metabolically engineered *E. coli*." *Microb. Cell Fact.* **9**:96. PMID:21110891.

34. Lippow, S.M.*, T. S. Moon*, S. Basu, S.-H. Yoon, X. Li, B.A. Chapman, K. Robison, D. Lipovšek, K.L.J. Prather. 2010. "Engineering enzyme specificity using computational design of a defined-sequence library." *Chem. Biol*. **17**:1306-1315. (*equal contribution)

35. Oliveira, P.H., K. L. J. Prather, D. M. F. Prazeres and G. A. Monteiro. 2011. "Mutation detection in plasmid biopharmaceuticals." *Biotechnol. J.* **6(4)**:378-391.

36. Dhamankar, H and K. L. J. Prather. 2011. "Microbial chemical factories: recent advances in pathway engineering for synthesis of value added chemicals." *Curr. Opin. Struct. Biol*. **21(4)**:488-494.

37. Solomon, K.V. and K. L. J. Prather. 2011. "The zero-sum game of pathway optimization: emerging paradigms for tuning gene expression." *Biotechnol. J*. **6(9)**:1064-1070.

38. Gonçalves, G.L., D.M. Bower, D.M. F. Prazeres, G.A. Monteiro, K.L.J. Prather. 2012. "Rational engineering of *E. coli* strains for plasmid biopharmaceutical manufacturing." *Biotechnol. J.* **7**:251-261.

39. Moon, T.S., D.R. Nielsen, K.L.J. Prather. 2012. "Sensitivity analysis of a proposed model mechanism for newly created glucose-6-oxidases." *AIChE J*. **58(8)**:2303-2308.

40. Bower, D.M., K.S. Lee, R.J. Ram, and K.L.J. Prather. 2012. "Fed-batch microbioreactor platform for scale down and analysis of a plasmid DNA production process." *Biotechnol. Bioeng.* **109(8)**:1976-1986.

41. Shiue, E. and K.L.J. Prather. 2012. "Synthetic biology devices as tools for metabolic engineering." *Biochem. Eng. J.* **65**:82-89.

42. Fernandes, F., J. Vidigal, M. Dias, K.L.J. Prather, M.J.T. Carrondo, A.S. Coroadinha, A.P. Teixeira, P.M. Alves. 2012. "Flipase-mediated cassette exchange in Sf9 insect cells for stable gene expression." *Biotechnol. Bioeng*. **109(11)**:2836-2844.

43. Gonçalves, G.A.L., D.M.F. Prazeres, G.A. Monteiro, K.L.J. Prather. 2013. "*De novo* creation of MG1655-derived *E. coli* strains specifically designed for plasmid DNA production." *Appl. Microbiol. Biotechnol.* **97**:611-620.

44. Solomon, K.V., T.S. Moon, B. Ma, T.M. Sanders, and K.L.J. Prather. 2013. "Tuning primary metabolism for heterologous productivity." *ACS Synth. Biol.* **2**:126-135. PMID:23656436.

45. Bower, D.M. and K.L.J. Prather. 2012. "Development of new plasmid DNA vaccine vectors with R1-based replicons." *Microb. Cell Fact.* **11**:107.

46. Solomon, K.V., T.M. Sanders, and K.L.J. Prather. 2012. "A dynamic metabolite valve for the control of central carbon metabolism." *Metab. Eng.* **14**:661-671. DOI: 10.1016/j.ymben.2012.08.006. PMID:23026120.

47. Tseng, H.-C. and K.L.J. Prather. 2012. "Controlled biosynthesis of odd-chain fuels and chemicals via engineered modular metabolic pathways." *Proc. Nat. Acad. Sci. USA* **109(44)**: 17925–17930. DOI: 10.1073/pnas.1209002109. PMID:23071297.

48. Martin, C.H., H. Dhamankar, H.-C. Tseng, M.J. Sheppard, and K.L.J. Prather. 2013. "A platform pathway for production of 3-hydroxyacids as value-added biochemicals - a biosynthetic route to 3-hydroxy-γ-butyrolactone." *Nat. Commun.* **4**:1414. DOI: 10.1038/ncomms2418. PMID:23361005.

49. Pirie, C., M. De Mey, K.L.J. Prather and P.K. Ajikumar. 2013. "Integrating the protein and metabolic engineering toolkits for next-generation chemical biosynthesis." *ACS Chem. Biol.***8**:662-672.

50. Prather, K.L.J. 2013. "The 'new' biotech industry" Current Opinion in Biotechnology. **24**(6): 963-964 (Editorial).

51. Abin-Fuentes, A., M. E. Mohamed, D.I.C. Wang and K.L.J. Prather. 2013. "Exploring the mechanism of biocatalyst inhibition in microbial desulfurization." *Appl. Environ. Microbiol.* **79(24)**:7807-7817.

52. Khademhosseini, A. and K.L.J. Prather. 2013. "Editorial: Biomolecular engineering - latest advances and applications" Biotechnology Journal, **8**(12):1366-1367.

53. Abin-Fuentes, A., J. C. Leung, M. E. Mohamed, D.I.C. Wang and K.L.J. Prather. 2014. "Rate-limiting step analysis of the microbial desulfurization of dibenzothiophene in a model oil system." *Biotechnol. Bioeng.***111(5)**:876-884.

54. McMahon, M.D. and K. L. J. Prather. 2014. "Functional screening and in vitro analysis reveal thioesterases with enhanced substrate specificity profiles that improve short-chain fatty acid production in *Escherichia coli*." *Appl. Environ. Microbiol.* **80(3)**:1042-1050. DOI: 10.1128/AEM.03303-13.

55. Shiue, E. and K.L.J. Prather. 2014. "Improving D-glucaric acid production from myo-inositol in *E. coli* by increasing MIOX stability and *myo*-inositol transport." *Metab. Eng.* **22**:22-31.

56. Hicks, M.A. and K.L.J. Prather. 2014. "Bioprospecting in the Genomic Age." In Sima Sariaslani, Geoffrey Gadd, editors: Advances in Applied Microbiology, Vol 87, AAM, UK: Academic Press, pp. 111-146.

57. Simcikova, M., K.L.J. Prather, D.M.F. Prazeres and G.A. Monteiro. 2014. "On the dual effect of glucose during production of pBAD/AraC-based minicircles." *Vaccine*. **32**:2843-2846.

58. Gonçalves, G.A.L., K.L.J. Prather, G.A. Monteiro, D.M.F. Prazeres. 2014. "Engineering of *Escherichia coli* strains for plasmid biopharmaceutical production: scale-up challenges." *Vaccine*. **32**:2847-2850.

59. Nielsen, J., M. Fussenbegger, J. Keasling, S.Y. Lee, J.C. Liao, K. Prather, B. Palsson. 2014. "Engineering synergy in biotechnology." *Nature Chem. Biol.* **10**:319-322.

60. Gonçalves, G.A.L., P. H Oliveira, A.G. Gomes, K.L.J. Prather, L.A. Lewis, D.M.F. Prazeres, and G.A. Monteiro. 2014. "Evidence that the insertion events of IS2 transposition are biased towards abrupt compositional shifts in target DNA and modulated by a diverse set of culture parameters." *Appl. Microbiol. Biotechnol.* **98**(15): 6609-6619, DOI 10.1007/s 00253-014-5695-6.

61. Lopes, M.B., G.A.L. Gonçalves, D. Felício-Silva, K.L.J. Prather, G.A. Monteiro, D.M.F. Prazeres, C.R.C. Calado. 2015. "In-situ NIR monitoring of plasmid bioproduction processes: effect of the

cultivation medium composition, the cultivation strategy and the Escherichia coli strain." *J. Chem. Technol. Biotechnol.* **90**(2):255-261, DOI: 10.1002/jctb.4431.

62. Gonçalves, G.A.L., K.L.J. Prather, G.A. Monteiro, A.E. Carnes, D.M.F. Prazeres. 2014. "Plasmid DNA production with *Escherichia coli* GALG20, a pgi-gene knockout strain: fermentation strategies and impact on downstream processing." *J. Biotechnol.* **186**:119-127, DOI: 10.1016/j.jbiotec.2014.06.008.

63. Dhamankar, H., Y. Tarasova, C.H. Martin, and K.L.J. Prather. 2014. "Engineering *E. coli* for the biosynthesis of 3-hydroxy-γ-butyrolactone (3HBL) as a value added chemical from glucose as a sole carbon source." *Metab. Eng.* **25**:72-81, DOI: 10.1016/j.ymben.2014.06.004. PMID:24954784.

64. Kunjapur, A.M., Y. Tarasova, K.L.J. Prather. 2014. "Synthesis and accumulation of aromatic aldehydes in an engineered strain of *Escherichia coli*." *J. Am. Chem. Soc.* **136**(33):11644–11654. DOI: 10.1021/ja506664a.

65. Rodrigues, J.L., M. Sousa, K.L.J. Prather, L.D. Kluskens, L.R. Rodrigues. 2014. "Selection of *Escherichia coli* heat shock promoters towards their application as stress probes." *J. Biotechnol*, **188**:61-71. DOI: 10.1016/j.jbiotec.2014.08.005.

66. Sheppard, M.J., A.M. Kunjapur, S.J. Wenck, K.L.J. Prather. 2014. "Retro-biosynthetic screening of a modular pathway design achieves selective route for microbial synthesis of 4-methyl-pentanol." *Nat. Commun.* **5**:5031. DOI: 10.1038/ncomms6031. PMID:25248664.

67. Shiue, E., I.M. Brockman, K.L.J. Prather. 2015. "Improving product yields on D-glucose in *Escherichia coli* via alternative carbon sources." *Biotechnol. Bioeng.***112**(3):579-587, DOI: 10.1002/bit.25470. PMID:25258165.

68. Rodrigues, J.L., K.L J. Prather, L.D. Kluskens, L.R. Rodrigues. 2015. "Heterologous production of curcuminoids: a review." *Microbiol. Mol. Biol. Rev*. **79**:39-60, DOI: 10.1128/MMBR.00031-14. PMID:25632188.

69. Brockman, I.M. and K.L.J. Prather. 2015. "Dynamic knockdown of *E. coli* central metabolism for redirecting fluxes of primary metabolites." *Metab. Eng.***28:**104-113, DOI: 10.1016/j.ymben.2014.12.005. PMID:25542851.

70. Rodrigues, J.L., R. G. Araújo, K.L.J. Prather, L.D. Kluskens, L.R. Rodrigues. 2015. "Production of curcuminoids from tyrosine by a metabolically engineered *Escherichia coli*." *Biotechnol. J.*, **10**(4):599-609, DOI: 10.1002/biot.201400637. PMID:25641677.

71. Kunjapur, A.M. and K.L.J. Prather. 2015. "Microbial engineering for aldehyde synthesis." *Appl. Environ. Microbiol*, **81**:1892–1901, DOI: 10.1128/AEM.03319-14. PMID:25576610.

72. Rodrigues, J.L., R.G. Araujo, K.L.J. Prather, L.D. Kluskens, L.R. Rodrigues. 2015. "Heterologous production of caffeic acid from tyrosine in *Escherichia coli*." *Enzyme. Microbiol. Technol.*, **71**:36-44, DOI: 10.1016/j.enzmictec.2015.01.001. PMID:25765308.

73. Cheng, D., R. Wang, K.L.J. Prather, K.L. Chow, I.-M. Hsing. 2015. "Tackling codon usage bias for heterologous expression in Rhodobacter sphaeroides by supplementation of rare tRNAs." *Enzyme Microbiol. Technol*., **72**:25-34, DOI: 10.1016/j.enzmictec.2015.02.003. PMID:25837504.

74. Brockman, I.M. and K.L.J. Prather. 2015. "Dynamic metabolic engineering: new strategies for developing responsive cell factories." *Biotechnol. J.* **10**(9): 1360–1369, DOI: 10.1002/biot.201400422. PMID:25868062.

75. Boock, J.T., A. Gupta, K.L.J. Prather. 2015. "Screening and modular design for metabolic pathway optimization." *Curr. Opin. Biotechnol.* **36**:189-198, DOI:10.1016/j.copbio.2015.08.013 (invited review). PMID:26432992.

76. Reizman, I.M.B., A.R. Stenger, C.R. Reisch, A. Gupta, N.C. Connors, K.L.J. Prather. 2015. "Improvement of glucaric acid production in *E. coli* via dynamic control of metabolic fluxes." *Metab. Eng. Comm.* **2**:109-116, DOI: 10.1016/j.meteno.2015.09.002. PMID:26478859.

77. Reisch, C.R. and K.L.J. Prather. 2015. "The no-SCAR (Scarless Cas9 Assisted Recombineering) system for genome editing in *Escherichia coli*." *Sci. Rep.* **5**: 15096, DOI: 10.1038/srep15096. PMID:26463009.

78. Pfleger, B.F. and K.L.J. Prather. 2015. "Biological synthesis unbounded?" *Nat. Biotechnol.* **33**(11):1148-1149. PMID:26544145.

79. Sheppard, M.J.*, A.M. Kunjapur*, K.L.J. Prather. 2016. "Modular and selective biosynthesis of gasoline-range alkanes." *Metab. Eng.* **33**:28-40, DOI: 10.1016/j.ymben.2015.10.010. (*equal contribution). PMID:26556131.

80. Tan, S.T., S. Manchester, K.L.J Prather. 2016. "Controlling central carbon metabolism for improved pathway yields in *Saccharomyces cerevisiae*." *ACS Syn. Biol.* **5**(2):116-124, DOI: 10.1021/acssynbio.5b00164. PMID:26544022.

81. Kunjapur, A.M., B. Cervantes, K.L.J. Prather. 2016. "Coupling carboxylic acid reductase to inorganic pyrophosphatase enhances cell-free *in vitro* aldehyde biosynthesis." *Biochem. Eng. J.* **109**: 19–27, DOI: 10.1016/j.bej.2015.12.018.

82. Simcikova, M., D.M. Prazeres, K.L.J. Prather, G.A. Monteiro. 2016. "Towards an effective non-viral gene delivery vector." *Biotechnol. Genet. Eng. Rev.*, **31**(1-2): 82-107, DOI: 10.1080/02648725.2016.1178011. PMID: 27160661.

83. Kunjapur, A.M., J.C. Hyun, K.L.J. Prather. 2016. "Deregulation of S-adenosylmethionine biosynthesis and regeneration improves methylation in the *E. coli* de novo vanillin biosynthesis pathway." *Microb. Cell Fact.* **15**: 61, DOI: 10.1186/s12934-016-0459-x. PMID:27067813.

84. Šimčíková, M., C.P.A. Alves, L. Brito, K.L.J. Prather, D.M.F. Prazeres, G.A. Monteiro. 2016. "Improvement of DNA minicircle production by optimization of the secondary structure of the 5'-UTR of ParA resolvase." *Appl. Microbiol. Biotechnol.* **100**(15): 6725-6737, DOI: 10.1007/s00253-016-7565-x. PMID:27147534.

85. Gupta, A.L., M.A. Hicks, S.P. Manchester, K.L.J. Prather. 2016. "Porting the synthetic D-glucaric acid pathway from *Escherichia coli* to *Saccharomyces cerevisiae*." *Biotechnol. J.* **11**(9): 1201-1208, DOI: 10.1002/biot.201500563. PMID:27312887.

86. Reisch, C.R. and K.L.J. Prather. 2017. "Scarless Cas9 Assisted Recombineering (no-SCAR) in *Escherichia coli*, an easy to use system for genome editing." *Curr. Prot. Mol. Biol.* **117**:31.8.1-31.8.20, DOI: 10.1002/cpmb.29. PMID:28060411.

87. Khlystov, N.A., W.Y. Chan, A.M. Kunjapur, W. Shi, K.L.J. Prather and B.D. Olsen. 2017. "Material properties of the cyanobacterial reserve polymer multi-L-arginyl-poly-L-aspartate (cyanophycin)." *Polymer*. **109**: 238–245, DOI: 10.1016/j.polymer.2016.11.058.

88. Gupta, A., I.M. Brockman Reizman, C.R. Reisch and K.L J. Prather. 2017. "Dynamic regulation of metabolic flux in engineered bacteria using a pathway-independent quorum-sensing circuit." *Nat. Biotechnol*. **35**:273–279, DOI: 10.1038/nbt.3796. PMID:28191902.

89. Rodrigues, J.L., M.R. Couto, R.G. Araújo, K.L.J. Prather, L. Kluskens, L.R. Rodrigues. 2017. "Hydroxycinnamic acids and curcumin production in engineered *Escherichia coli* using heat shock promoters." *Biotechnol. J.* **125**:41-49, DOI: 10.1016/j.bej.2017.05.015.

90. Tan, S.Z. and K.L.J. Prather. 2017. "Dynamic pathway regulation: recent advances and methods of construction." *Curr. Opin. Chem. Biol.* **41**:28–35, DOI: 10.1016/j.cbpa.2017.10.004.

91. Haslinger, K. and Prather, K.L.J. 2017. "Pathway towards renewable chemicals." *Nat. Microbiol*. **2**:1580–1581. DOI: 10.1038/s41564-017-0071-9.

92. Tompsett, G.A., J.T. Boock, C. DiSpirito, E. Stoltz, D.R. Knutson, A.G. Rivard, M.R. Overdevest, C. N. Conlon, K.L.J. Prather, J.R. Thompson, M.T. Timko. 2018. "Extraction rate and energy efficiency of supercritical carbon dioxide recovery of higher alcohols from dilute aqueous solution." *Energy Technology*. **6**(4): 683-693. DOI: 10.1002/ente.201700626.

93. Tan, S.Z., C.R. Reisch, K.L.J. Prather. 2018. "A Robust CRISPRi Gene Repression System in *Pseudomonas.*" *J. Bacteriol.* **200**(7): e00575-17. DOI: 10.1128/JB.00575-17.

94. Anderson, L.A., M.A. Islam, K.L.J.Prather. 2018. "Synthetic biology strategies for improving microbial synthesis of "green" biopolymers." *J. Biol. Chem.* **293**(14):5053–5061. DOI: 10.1074/jbc.TM117.000368.

95. Doong, S.J., A. Gupta, K.L.J. Prather. 2018. "Layered dynamic regulation for improving metabolic pathway productivity in *Escherichia coli*." *Proc. Nat. Acad. Sci. USA.* **115**(12):2964-2969. DOI: 10.1073/pnas.1716920115.

96. Bonk, B.M., Y. Tarasova, M.A. Hicks, B. Tidor, and Kristala L.J. Prather. 2018. "Rational design of thiolase substrate specificity for metabolic engineering applications." *Biotechnol. Bioeng.* **115**:2167–2182. DOI: 10.1002/bit.26737.

97. Amorim, C., S.C. Silvério, S.P. Silva, E. Coelho, M.A. Coimbra, K.L.J. Prather, L.R. Rodrigues. 2018. "Single-step production of arabino-xylooligosaccharides by recombinant *Bacillus subtilis* 3610 cultivated in brewers' spent grain." *Carbohydrate Polymers.* **199**:546–554. DOI: 10.1016/j.carbpol.2018.07.017.

98. Haris, S., C. Fang, J.-R. Bastidas-Oyanedel, K.J. Prather, J.E. Schmidt, M.H. Thomsen. 2018. "Natural antibacterial agents from arid-region pretreated lignocellulosic biomasses and extracts for the control of lactic acid bacteria in yeast fermentation." *AMB Express*. **8**:127. DOI: 10.1186/s13568-018-0654-8.

99. Freedman, A.J., K.C. Peet, J.T. Boock, K. Penn, K.L.J. Prather, J.R. Thompson. 2018. "Isolation, development, and genomic analysis of *Bacillus megaterium* SR7 for growth and metabolite

production under supercritical carbon dioxide." *Front. Microbiol.* **9**:2152. DOI: 10.3389/fmicb.2018.02152.

100. Prather, K.L.J. 2019 "Chemistry as biology by design." Microbial Biotechnology. **12**(1):30–31. DOI: 10.1111/1751-7915.13345.

101. Amorim, C., S.C. Silvério, R.F S. Gonçalves, A.C. Pinheiro, S. Silva, E. Coelho, M.A. Coimbra, K.L.J. Prather, L.R. Rodrigues. 2019. "Downscale fermentation for xylooligosaccharides production by recombinant *Bacillus subtilis* 3610." *Carbohydrate Polymers*. **205**:176-183. DOI: 10.1016/j.carbpol.2018.09.088.

102. Boock, J.T., A.J.E. Freedman, G.A. Tompsett, S.K. Muse, A.J. Allen, L.A. Jackson, B. Castro-Dominguez, M.T. Timko, K.L.J. Prather (co-corresponding author), J.R. Thompson. 2019. "Engineered microbial biofuel production and recovery under supercritical carbon dioxide." *Nat. Commun.* **10**:587. DOI: 10.1038/s41467-019-08486-6.

103. Amorim, C., S.C. Silverio, K.L.J. Prather, L.R.M. Rodrigues. 2019. "From lignocellulosic residues to market: production and commercial potential of xylooligosaccharides." *Biotechnol. Adv.* **37**:107397. DOI: 10.1016/j.biotechadv.2019.05.003.

104. Kunjapur, A.M. and K.L.J. Prather. 2019. "Development of a vanillate biosensor for the vanillin biosynthesis pathway in *E. coli*." *ACS Synth. Biol.* **8:**1958-1967. DOI: 10.1021/acssynbio.9b00071.

105. Dinh, C.V. and K.L.J. Prather. 2019. "Development of an autonomous and bifunctional quorum-sensing circuit for metabolic flux control in engineered *Escherichia coli*." *Proc. Nat. Acad. Sci. USA.* **116**(51):25562-25568. DOI: 10.1073/pnas.1911144116.

106. Dinh, C.V., X. Chen, K.L.J. Prather. 2020. "Development of a quorum-sensing based circuit for control of co-culture population composition in a naringenin production system." *ACS Synth. Biol.* **9**(3):590-597. DOI: 10.1021/acssynbio.9b00451.

107. Haslinger, K. and K.L.J. Prather. 2020. "Heterologous caffeic acid biosynthesis in *Escherichia coli* is affected by choice of tyrosine ammonia lyase and redox partners for bacterial Cytochrome P450." *Microb. Cell Fact.* **19**:26. DOI: 10.1186/s12934-020-01300-9.

108. Prather, K.L.J. 2020 "Accelerating and expanding nature to address its greatest challenges." *Nat. Catal.* **3**:181–183. DOI: 10.1038/s41929-020-0422-4.

109. Dinh, C.V. and K.L.J. Prather. 2020. "Layered and multi-input autonomous dynamic control strategies for metabolic engineering." *Curr. Opin. Biotechnol.* **65**: 156-162. DOI: 10.1016/j.copbio.2020.02.015.

110. Fox, K.J. and K.L.J. Prather. 2020. "Carbon catabolite repression relaxation in *Escherichia coli*: global and sugar-specific methods for glucose and secondary sugar co-utilization." *Curr. Opin. Chem. Eng.* **30**:9-16. DOI: 10.1016/j.coche.2020.05.005

111. Marques, W.L., L.A. Anderson, L. Sandoval, M.A. Hicks, K.L.J. Prather. 2020. "Sequence-based bioprospecting of myo-inositol oxygenase (Miox) reveals new homologues that increase glucaric acid production in *Saccharomyces cerevisiae*." *Enzyme Microb. Technol.* **140**: 109623. DOI: 10.1016/j.enzmictec.2020.109623.

112. Fox, K.J. and K.L.J. Prather. 2020. "Production of D-glyceric acid from D-galacturonate in *Escherichia coli*." *J. Ind. Microbiol. Biotechnol.* **47**:1075–1081. DOI: 10.1007/s10295-020-02323-2.

113. Zu, Y., K.L.J. Prather, G. Stephanopoulos. 2020. "Metabolic engineering strategies to overcome precursor limitations in isoprenoid biosynthesis," *Curr. Opin. Biotechnol.* **66**:171-178. DOI: 10.1016/j.copbio.2020.07.005.

114. Cleto S., K. Haslinger, K.L.J. Prather, T. K. Lu. 2021. "Natural combinatorial genetics and prolific polyamine production enable siderophore diversification in *Serratia plymuthica*." *BMC Biol.* **19**:46**.** DOI: 10.1186/s12915-021-00971-z.

115. Ni, C., C.V. Dinh, K.L.J. Prather. 2021. "Dynamic control of metabolism." *Annu. Rev. Chem. Biomol. Eng.* **12**:519-541. DOI: 10.1146/annurev-chembioeng-091720-125738.

116. Vila-Santa, A., M.A. Islam, F.C. Ferreira, K.L.J. Prather, N.P. Mira. 2021. "Prospecting biochemical pathways to implement microbe-based production of the new-to-nature platform chemical levulinic acid." *ACS Synth. Biol.* **10**(4):724-736. DOI: 10.1021/acssynbio.0c00518.

117. Haslinger, K., T. Hackl, K.L J. Prather. 2021. "Rapid *in vitro* prototyping of O-methyltransferases for pathway applications in *Escherichia coli*." *Cell Chem. Biol.* **28**(6): 876-886.e4. DOI: 10.1016/j.chembiol.2021.04.010.

118. Almeida, B.C., J.A. Kaczmarek, P.R. Figueiredo, K.L.J. Prather, Alexandra T. P. Carvalho. 2021. "Transcription factor allosteric regulation through substrate coordination to zinc." *NAR Genom. Bioinform.* **3**(2), lqab033. DOI: 10.1093/nargab/lqab033.

119. Ni, C., K.J. Fox, K.L.J. Prather. 2021. "Substrate-Activated Expression of a Biosynthetic Pathway in *Escherichia coli*." *Biotechnol. J.* DOI: 10.1002/biot.202000433.

120. Kaczmarek, J.A., K.L.J. Prather. 2021. "Effective use of biosensors for high-throughput library screening for metabolite production." *J. Ind. Microbiol. Biotechnol.* **48**, kuab049. DOI: 10.1093/jimb/kuab049.

121. Li, C., C.A. Swofford, C. Rückert, A.O. Chatzivasileiou, R. Ou, P. Opdensteinen, T. Luttermann, K. Zhou, G. Stephanopoulos, K.L.J. Prather, E.Z.L. Zhong-Johnson, S. Liang, S. Zheng, Y. Lin, A.J. Sinskey. 2021. "Heterologous production of α-carotene in *Corynebacterium glutamicum* using a multi-copy chromosomal integration method." *Bioresour. Technol.* **341**:125782. DOI: 10.1016/j.biortech.2021.125782.

122. Cui, X., X. Ma, K.L.J. Prather, K. Zhou. 2021. "Controlling protein expression by using intron-containing promoters in *Saccharomyces cerevisiae*." *Biochem. Eng. J.* **176**:108197. DOI: 10.1016/j.bej.2021.108197.

123. Vila-Santa, A., F.C. Mendes, F.C. Ferreira, K.L.J. Prather, N.P. Mira. 2021. "Implementation of synthetic pathways to foster microbe-based production of non-naturally occurring carboxylic acids and derivatives." *J. Fungi*. **7**(12):1020. DOI: 10.3390/jof7121020.

124. Ma, X., H. Liang, Q. Pan, K.L.J. Prather, A.J. Sinskey, G. Stephanopoulos, and K. Zhou. 2022. "Optimization of the isopentenol utilization pathway for isoprenoid synthesis in *Escherichia coli*." *J. Agric. Food Chem.* **70**(11):3512-3520. DOI: 10.1021/acs.jafc.2c00014.

125. Liu, C., X. Cui, W. Chen, X. Ma, K.J. Prather, K. Zhou, J. Wu. 2022, "Synthesis of oxygenated sesquiterpenoids enabled by combining metabolic engineering and visible-light photocatalysis." *Chem. Eur. J.* **28**:e2022012. DOI: 10.1002/chem.202201230.

Patents

1. "Methods for microbial production of terpenoids." US Patent No. 8,062,878. Issued November 22, 2011

2. "Microbial production of 3-hydroxyacids from glucose and glycolate." US Patent No. 8,361,760. Issued January 29, 2013

3. "Microbial production of 3,4-dihydroxybutyrate (3,4-DHBA), 2,3- dihydroxybutyrate (2,3-DHBA) and 3-hydroxybutyrolactone (3-HBL)." US Patent No. 8,669,379. Issued March 11, 2014

4. "Glucose valve and other metabolite valves." US Patent No. 8,835,138. Issued September 16, 2014.

5. "Cellular production of glucaric acid through recombinant expression of uronate dehydrogenase and *myo*-inositol oxygenase." US Patent No. 8,835,147. Issued September 16, 2014.

6. "Microbial production of branched medium chain alcohols, such as 4-methylpentanol." US Patent No 10,100,335. Issued October 16, 2018.

7. "Microbial system for biosynthesis of natural and engineered products coupled to *in situ* extraction in supercritical CO_2." US Patent No 10,941,379. Issued March 9, 2021.

Invited Lectures

1. Biological Engineering Division, MIT, October 6, 2005

2. Office of Naval Research Green Synthesis Review Meeting, January 9, 2006

3. Department of Chemistry, University of Massachusetts-Boston, May 3, 2006

4. US-UK Biocatalysis Conference, British Consulate, Cambridge, MA, May 26, 2006

5. Department of Biochemical Engineering, University College London, England, UK, September 27, 2006

6. UK Global Watch Biocatalysis Mission Dissemination Day, York, England, UK, September 28, 2006

7. Annual Biomedical Research Conference for Minority Students (ABRCMS), Scientific Session Speaker, Nov 9, 2006

8. Informa IBC/Informa Learning Conference on Synthetic Biology, March 27, 2007

9. Department of Microbiology & Immunology/PREP Program, University of Rochester, April 16, 2007

10. Department of Biological Sciences, Carnegie Mellon University, October 10, 2007

11. Institute for Genomic Biology Symposium, Keynote Speaker, University of Illinois at Urbana-Champaign, April 5, 2008

12. MIT Club of South Texas, Houston, TX, May 13, 2008

13. Synthetic Biology 4.0, Hong Kong University of Science and Technology, October 10, 2008

14. Department of Chemical and Biomolecular Engineering, Hong Kong University of Science and Technology, October 13, 2008

15. European-American Innovation Day, Boston, MA, December 3, 2008

16. Advances in Synthetic Biology 2009, London, UK, April 29, 2009

17. 3rd Summit on System Biology: The Microbial World and Beyond, Richmond, VA, June 17, 2009

18. BIO World Congress on Industrial Biotechnology and Bioprocessing, Montreal, QC, Canada, July 21, 2009

19. Society for Industrial Microbiology 2009 Annual Meeting, Toronto, ON, Canada, July 27, 2009

20. Department of Chemical Engineering, University of Massachusetts Amherst, September 29, 2009

21. Topics in Bioengineering Seminar Series, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, October 20, 2009

22. Ontario Genomics Institute-IDT Synthetic Biology Symposium, Toronto, ON, Canada, October 27, 2009

23. American Society for Gravitational and Space Biology Annual Meeting, Raleigh, NC, November 7, 2009

24. Department of Chemistry, Wellesley College, Wellesley, MA, November 23, 2009

25. Brookhaven National Laboratory, Upton, NY, January 8, 2010

26. MIT in Japan Conference, Tokyo, Japan, January 22, 2010

27. Mathematical Biosciences Institute (MBI) Workshop on Synthetic Biology, Columbus, OH, January 27, 2010

28. Symposium on The Application of Synthetic Biology to Biofuel Production, University of Alberta, Edmonton, Calgary, Canada, May 21, 2010

29. American Society for Microbiology 2010 Annual Meeting, San Diego, CA, May 25, 2010

30. Society for Industrial Microbiology 2010 Annual Meeting, San Francisco, CA, August 4, 2010

31. Biotechnology Seminar Series, Biotechnology Training Program, Northwestern University, Evanston, IL, September 1, 2010

32. Department of Chemical and Biological Engineering, Iowa State University, Ames, IA, September 2, 2010

33. National Academy of Science Kavli Frontiers in Science Symposium, Irvine, CA, November 6, 2010

34. American Institute of Chemical Engineers (AIChE), Special Session in honor of Dr. Fred Heineken, Salt Lake City, UT, November 9, 2010

35. Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA, December 2, 2010

36. Institute of Chemical Sciences and Engineering, École Polytechnique Fédérale de Lausanne, Switzerland, December 13, 2010

37. International Conference on Synthetic Biology, Evry, France, December 16, 2010

38. IDEASlab, World Economic Forum, Davos, Switzerland, January 26, 2011

39. 2nd Annual Bio-Based Chemicals Summit, San Diego, CA, February 14, 2011

40. Department of Chemical Engineering, Texas Tech University, Lubbock, TX, April 8, 2011

41. Department of Biochemistry and Molecular Biology, University of Chicago, Chicago, IL, April 27, 2011

42. Biology by Design Symposium, Northwestern University, Evanston, IL, May 11, 2011

43. American Society for Microbiology Annual Meeting, New Orleans, LA, May 24, 2011

44. Systems & Synthetic Biology Workshop, University of Minho, Braga, Portugal, June 6, 2011

45. Biochemical Engineering Journal Young Investigator Award Presentation, Biochemical Engineering Conference, Seattle, WA, June 26, 2011

46. 2011 Gordon Research Conference on Enzymes, Coenzymes and Metabolic Pathways, Waterville Valley, NH, July 12, 2011

47. GlaxoSmithKline, Inc., King of Prussia, PA, August 23, 2011

48. National Science Foundation Catalysis Workshop, Denver, CO, August 27, 2011

49. 242nd American Chemical Society National Meeting, Denver, CO, August 29, 2011

50. 2011 IEEE Engineering in Medicine and Biology Conference, Boston, MA, August 2011

51. Horizons in Molecular Biology Conference, Göttingen, Germany, September 17, 2011

52. Department of Chemical & Biomolecular Engineering, University of Illinois at Urbana-Champaign, September 27, 2011

53. ESF-EMBO Symposium on 'Synthetic Biology of Antibiotic Production', Sant Feliu de Guixols, Spain, October 6, 2011

54. Department of Chemical Engineering, Texas A&M University, College Station, Texas, November 2, 2011

55. Department of Chemical and Biomolecular Engineering, Rice University, Houston, Texas, November 3, 2011

56. Keynote Speaker, 2011 Samsung Tech Conference, Seoul, Republic of Korea, November 8, 2011

57. Department of Chemical Engineering, Stanford University, Palo Alto, CA, November 14, 2011

58. DSM/Microbia Precision Engineering, Lexington, MA, November 16, 2011

59. CCB (Chemistry and Chemical Biology Graduate Program)/iPQB (Integrative Program in Quantitative Biology) Seminar Series, University of California, San Francisco, January 19, 2012

60. Department of Chemical and Biological Engineering, University of Wisconsin-Madison, April 10, 2012

61. Microbial Sciences Symposium, Harvard University, Cambridge, MA, April 14, 2012

62. "Supermodel Genetics: Chemical Screens and Synthetic Genomes" conference, The Royal Society (London), London, UK, April 20, 2012

63. Department of Chemical Engineering, University of Delaware, Newark, DE, April 27, 2012

64. Department of Chemistry, Princeton University, Princeton, NJ, May 3, 2012

65. Pfizer Fermentation Summit, Madison, NJ, June 12, 2012

66. Keynote Speaker, Gordon Research Seminar on Biocatalysis, Smithfield, RI, July 7, 2012

67. 2012 Gordon Research Conference on Biocatalysis, Smithfield, RI, July 10, 2012

68. IDEASlab, World Economic Forum, Tianjin, China, September 11, 2012

69. Donald Danforth Plant Science Center 14th Annual Fall Symposium, St. Louis, MO, September 27, 2012.

70. Department of Chemistry, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Portugal, October 3, 2012.

71. Van Ness Lecture, Department of Chemical & Biological Engineering, Rensselaer Poyltechnic Institute, Troy, NY, October 17-18, 2012.

72. Department of Biochemistry, Biophysics & Molecular Biology, Iowa State University, Ames, IA, October 25, 2012.

73. Topics in Bioengineering Seminar Series, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, November 6, 2012.

74. Department of Chemical & Biochemical Engineering, Ohio State University, Columbus, OH, November 8, 2012.

75. Frontiers in Systems and Synthetic Biology ’13, Atlanta, GA, March 23, 2013.

76. School of Chemical and Biomolecular Engineering, Cornell University, Ithaca, NY, April 18, 2013.

77. American Society for Biochemistry and Molecular Biology (ASBMB) 2013 Annual Meeting, Boston, MA, April 23, 2013.

78. GlaxoSmithKline Global Chemistry Conference, Boston, MA, April 23, 2013.

79. 3rd Copenhagen Bioscience Conference, “Cell Factories and Biosustainability,” Copenhagen, Denmark, May 7, 2013.

80. Council for Chemistry Research Annual Meeting, Alexandria, VA, May 20, 2013

81. Federation of European Microbiological Societies (FEMS) 2013 Congress, Leipzig, Germany, July 21, 2013.

82. Women in the Life Sciences Seminar, International Giessen Graduate Centre for the Life Sciences (GGL), Justus-Liebig-University Giessen, Germany, July 25, 2013.

83. Synthetic Biology Session, Society for Industrial Microbiology and Biotechnology Annual Meeting, San Diego, CA, August 12, 2013.

84. Synthetic Genomics, LaJolla, CA, August 14, 2013.

85. Biocatalysis Session, Society for Industrial Microbiology and Biotechnology Annual Meeting, San Diego, CA, August 15, 2013.

86. Enzyme Engineering XII, Toyoma, Japan, September 24, 2013.

87. Keynote Lecture, Jülich Biotech Day, Jülich, Germany, October 11, 2013.

88. Chemical Engineering Department, Columbia University, New York, NY, October 22, 2013.

89. Department of Chemistry, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Portugal, January 29, 2014.

90. School of Chemical, Biological & Materials Engineering, University of Oklahoma, Norman, OK, February 20, 2014.

91. Women of BIOT Symposium, American Chemical Society Spring Annual Meeting, March 16, 2014.

92. Keynote Lecture, Upstream Processes Symposium, Biochemical Technology Division, American Chemical Society Spring Annual Meeting, March 17, 2014.

93. LOEWE Center for Synthetic Microbiology Symposium on Microbial formation of Biofuels and Platform Biochemicals, Marburg, Germany, May 7, 2014.

94. American Society for Microbiology Annual Meeting, Boston, MA, May 19, 2014.

95. Metabolic Engineering X, Vancouver, BC, Canada, June 16, 2014.

96. BASF, Tarrytown, NY, July 9, 2014.

97. Department of Microbiology/Immunology, Loyola University, Chicago, IL, September 11, 2014.

98. Department of Chemical Engineering, The Pennsylvania State University, University Park, PA, September 18, 2014.

99. Department of Chemical and Biological Engineering, Tufts University, Medford, MA, September 22, 2014.

100. John Innes Center, Norwich, UK, October 3, 2014.

101. Plenary Speaker, 4th International Conference on Novel Enzymes, Ghent, Belgium, October 15, 2014.

102. Keynote Lecture, 16th EMBL-PhD Symposium, Heidelberg, Germany, October 25, 2014.

103. Dr. Bruce J. Nelson '74 Distinguished Speaker Series, Harvey Mudd College, Claremont, CA, November 4, 2014.

104. Merck Lectureship in Chemical Engineering, University of Virginia, Charlottesville, VA, November 6, 2014.

105. 2015 Keystone Symposia on Precision Genome Engineering and Synthetic Biology, January 15, 2015.

106. Department of Chemical & Biological Engineering, Colorado State University, Ft. Collins, CO, February 6, 2015.

107. Lloyd N. Ferguson Lectures, California State University Los Angeles, CA, February 12-13, 2014.

108. American Physical Society March Meeting, San Antonio, TX, March 4, 2015.

109. 2015 Synthetic Biology: Engineering, Evolution & Design (SEED) Conference, Boston, MA, June 11, 2015.

110. Biotechnology Industry Organization (BIO) International Convention (Panelist), Philadelphia, PA, June 16, 2015.

111. Bristol-Myers Squibb, Hopkinton, MA, June 25, 2015.

112. Keynote Speaker, 7th Annual Chemical Biology Interface Summer Retreat, Departments of Chemistry and Biochemistry & Molecular Biophysics, University of Pennsylvania, Villanova, PA, July 7, 2015.

113. Biochemical and Molecular Engineering XIX, Puerto Vallarta, Mexico, July 13, 2015.

114. ECAB3 – 3rd European Conference of Applied Biotechnology, Nice, France, October 1, 2015.

115. ProkaGENOMICS 2015, (6th European Conference on Prokaryotic and Fungal Genomics), Göttingen, Germany, October 2, 2015.

116. Department of Chemical Engineering, University of Washington, Seattle, WA, October 26, 2015.

117. Department of Chemistry, University of California, Davis, CA, October 27, 2015.

118. 2015 National Association of Biology Teachers Professional Development Conference, Providence, RI, November 12, 2015.

119. Pacifichem 2015 (The International Chemical Congress of Pacific Basin Societies), Honolulu, HI, December 17, 2015.

120. American Association for the Advancement of Science (AAAS) Annual Meeting, Washington, DC, February 11, 2016.

121. 2016 Academic Research and Leadership Network Research Symposium, Cambridge, MA, March 25, 2016.

122. Martin H. Freeman Lecture (inaugural lecture), Middlebury College, Middlebury, VT, April 8, 2016.

123. Metabolic Engineering XI, Kobe, Japan, June 29, 2016.

124. Society for Industrial Microbiology & Biotechnology Annual Meeting, New Orleans, LA, July 25, 2016.

125. American Chemical Society (ACS) Green Chemistry Institute (GCI) Pharmaceutical Roundtable Symposium, Cambridge, MA, October 13, 2016.

126. 17th International Biotechnology Symposium – IBS2016, Melbourne, Australia, October 24, 2016.

127. Division 15C Invited Lecture, American Institute of Chemical Engineers (AIChE) Annual Meeting, San Francisco, CA, November 2016.

128. Novozymes Prize Symposium, Novo Nordisk Foundation, Copenhagen, Denmark, November 21, 2016.

129. 7th International Conference on Biomolecular Engineering (ICBE), San Diego, CA, January 9, 2017.

130. Biogen, 2017 Biogen Black History Month Pioneer Seminar Series, Cambridge, MA, February 23, 2017.

131. Nano @ Wayne Seminar Series, Wayne State University, Detroit, MI, April 18, 2017.

132. Hampton University, Partnership for Research and Education in Materials (PREM) Seminar Series, Hampton, VA, April 28, 2017.

133. Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota, St. Paul, MN, September 14, 2017.

134. Metabolic Engineering Summit 2017, Beijing, China, October 24, 2017.

135. Department of Chemical and Biological Engineering, University of Colorado at Boulder, January 23, 2018.

136. 6th Annual Winter q-bio Meeting, Wailea, HI, February 22, 2018.

137. Keynote Speaker, Joint Genome Institute Annual User Meeting, San Francisco, CA, March 16, 2018.

138. Lectures at the Leading Edge, Department of Chemical Engineering & Applied Chemistry, University of Toronto, Canada, March 28, 2018.

139. Synthetic Biology Mini-Symposium, Department of Biochemistry & Molecular Biology, University of Georgia, Athens, GA, April 6, 2018.

140. Department of Chemical and Biological Engineering, Iowa State University, Ames, IA, April 26, 2018.

141. Advances in Biotechnology, Northwestern University, Evanston, IL, May 2, 2018.

142. Department of Chemical and Biological Engineering, Northwestern University, Evanston, IL, May 3, 2018.

143. Department of Chemical Engineering, Worcester Polytechnic Institute, May 9, 2018.

144. Department of Chemical Engineering, University of California, Santa Barbara, May 22, 2018.

145. Metabolic Engineering XII, Münich, Germany, June 25, 2018.

146. 18th European Congress on Biotechnology, July 4, 2018.

147. Plenary Lecture, 2018 Gordon Research Conference on Biocatalysis, Bidderford, ME, July 19, 2018.

148. Society for Industrial Microbiology & Biotechnology Annual Meeting, Chicago, IL, August 14, 2018.

149. Synthetic Biology: The State of the Science Symposium, 256th American Chemical Society National Meeting, Boston, MA, August 20, 2018.

150. Copenhagen Plant Science Center, University of Copenhagen, Denmark, August 23, 2018.

151. Synthetic Biology for Defense Workshop, Arlington, VA, September 27, 2018.

152. Annual Biomedical Research Conference for Minority Students (ABRCMS) 2018 Meeting, Indianapolis, IN, November 15, 2018.

153. Department of Chemical & Biological Engineering, Colorado School of Mines, Golden, CO, February 1, 2019.

154. 2nd Israeli Synthetic Biology Meeting, Weizmann Institute of Technology, Rehovot, Israel, March 11, 2019.

155. American Chemical Society, BIOT Division Keynote, Orlando, FL, March 31, 2019.

156. Davidson School of Chemical Engineering, Purdue University, West Lafayette, IN, April 9, 2019.

157. Department of Chemical and Biomolecular Engineering, Tulane University, New Orleans, LA, April 12, 2019.

158. Department of Chemical and Biological Engineering, Princeton University, Princeton, NJ, May 7, 2019.

159. Daesung Haegang Microbes Forum, Seoul, South Korea, June 20, 2019.

160. Korean Society for Microbiology and Biotechnology (KMB), 46th Annual Meeting, Jeju Island, South Korea, June 25, 2019.

161. Biochemical and Molecular Engineering XX1, Mont Tremblant, QC, Canada, July 18, 2019.

162. Society for Industrial Microbiology & Biotechnology (SIMB) 2019 Annual Meeting, Washington, DC, July 24, 2019.

163. EMBO Practical Course: Synthetic Biology in Action, Heidelberg, Germany, September 20, 2019.

164. Thinking Out Loud Presidential Colloquium Series, Brown University, Providence, RI, October 9, 2019.

165. AfroBiotech Conference, Atlanta, GA, October 28, 2019.

166. Department of Bioengineering, University of Illinois, Urbana-Champaign, IL, October 30, 2019.

167. School for Engineering of Matter, Transport and Energy, Arizona State University, Tempe, AZ, November 4, 2019.

168. Division 15c Keynote Lecture, American Institute of Chemical Engineers (AIChE) Annual Meeting, Orlando, FL, November 11, 2019.

169. 2019 Climate Change Workshop, Boston University, Boston, MA, December 3, 2019.

170. University of Washington Genome Sciences Symposium (virtual), November 13, 2020.

171. The Metabolic Engineering Virtual Seminar Series Hosted by The Alper Laboratory at UT-Austin, January 15, 2021.

172. Department of Chemical Engineering, University of Massachusetts-Amherst (virtual), January 26, 2021.

173. Distinguished Lecturer, Department of Chemical Engineering, Northeastern University (virtual), Boston University, April 7, 2021.

174. Department of Chemical and Biological Engineering, Seoul National University, South Korea (virtual), May 17/18, 2021.

175. Sanders Tri-Institutional Chemical Biology Seminar Series, New York, NY (virtual), May 24, 2021.

176. 2021 Synthetic Biology: Engineering, Evolution & Design (SEED) Conference (virtual), June 18, 2021.

177. American Society for Microbiology, World Microbe Forum (virtual), June 21, 2021.

178. Fredrickson Lecture, Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN, October 26, 2021.

179. Class of 1960 Scholars Program Seminar, Biochemistry and Molecular Biology Program, Williams College, Williamstown, MA, October 29, 2021.

180. 2nd International BioDesign Research Conference (virtual), December 13, 2021.

181. VAAM Annual Conference of the Association for General and Applied Microbiology (virtual), February 22, 2022.

182. Department of Chemical Engineering, Stanford University, Stanford, CA, March 7, 2022.

183. Keynote Lecture, Microbial Engineering II, Albufeira, Portgual, April 5, 2022.

184. Keynote Lecture, 44th Symposium on Biomaterials, Fuels, and Chemicals, Society for Industrial Microbiology and Biotechnology, New Orleans, LA, May 1, 2022.

185. Keynote Lecture, Enzyme Engineering XXVI, Dallas/Fort Worth, TX, May 23, 2022.

186. 26th Annual Green Chemistry & Engineering Conference, ACS Green Chemistry Institute (virtual), June 7, 2022.

187. Environmental Microbiology Lecture, Society for Applied Microbiology, London, UK, October 6, 2022.

188. Keynote Lecture, NanoImpacts 2022: SemiSynBio and Beyond, Joint School of Nanoscience and Nanoengineering, North Carolina A&T University and University of North Carolina, Greensboro, October 15, 2022.

189. Andreas Acrivos Lecture, American Institute of Chemical Engineers (AIChE) Annual Meeting, Phoenix, AZ, November 15, 2022.

Contributed Conference Presentations

1. *AIChE Annual Meeting, Los Angeles, CA, Nov. 1997*. Poster: "Using mRNA Stabilization to Enhance Prokaryotic Protein Synthesis." Trent A. Carrier [Speaker], Kristala L. Jones, and Jay D. Keasling

2. *AIChE Annual Meeting, Los Angeles, CA, Nov. 1997*. Paper: "Construction, Stability, and Expression of Low-Copy Vectors Derived from the *E. coli* F Plasmid." Kristala L. Jones [Speaker] and Jay D. Keasling.

3. *NOBCChE Annual Meeting, Dallas, TX, April 1998*. Paper: "Development of Low-Copy Mini-F Vectors for Long-Term Gene Expression in *Escherichia coli*" Kristala L. Jones [Presenter] and Jay D. Keasling.

4. *AIChE Annual Meeting, Miami Beach, FL, Nov. 1998*. Paper: "Plasmid Vehicles for Long-Term, Variable Gene Expression in *Escherichia coli*." Kristala L. Jones [Speaker], Trent A. Carrier, and Jay D. Keasling.

5. *Biochemical Engineering XIII, Boulder, CO, July 2003*. Poster: Characterization of structural plasmid instability through multiplex quantitative PCR. Jerrell W. Herod and Kristala L. Jones Prather [Presenter]

6. *The Waterside Conference: Process Development and Production Issues for Monoclonal & Recombinant Antibodies, Beverly Hills, CA, May 2004*. Poster: Development of transfection and selection protocols for high expression of monoclonal antibodies in GS/CHOK1SV and DHFR-CHO cells. M. Celina Edmonds [Presenter], Kristala L. Jones Prather, Krista Alvin, Lily Chu, Peter M. Salmon, David K. Robinson

7. *American Chemical Society Fall Annual Meeting, September 2006.* Paper: "Novel pathways for the microbial production of organic compounds." Kristala Jones Prather [Presenter], Collin Martin, Pooya Iranpour, Tae Seok Moon

8. *Metabolic Engineering VI, The Netherlands, October 2006.* Poster: "Novel Pathway Design for Microbial Production of Organic Compounds." Kristala Jones Prather [Presenter], Collin Martin, Pooya Iranpour, Tae Seok Moon

9. *AIChE Annual Meeting, San Francisco, CA, November 2006.* Poster: "Development of a database tool for novel biosynthetic pathway design." Wei Chan, Amanda Lanza, Kristala Jones Prather [Presenter]

10. AIChE Annual Meeting, San Francisco, CA, November 2006. Poster: " 'Retro-biosynthetic' design for the microbial production of an organic compound." Collin Martin [Presenter] and Kristala Jones Prather

11. *Biochemical Engineering XV, Quebec City, QC, Canada, July 2007*. Poster: "Towards microbial synthesis of glucaric acid." Tae Seok Moon, Pooya Iranpour, Amanda Lanza, Leah Octavio, Kristala Jones Prather [Presenter]

12. *American Chemical Society Fall Annual Meeting, Boston, MA, August 2007*. Paper: "Towards microbial synthesis of glucaric acid." Tae Seok Moon [Presenter], Pooya Iranpour, Amanda Lanza, Leah Octavio, Kristala Jones Prather

13. *American Chemical Society Fall Annual Meeting, Boston, MA, August 2007*. Poster: "ReBit: a database for enzymatic pathway design." Collin Martin [Presenter] and Kristala Jones Prather

14. *AIChE Annual Meeting, Salt Lake City, UT, November 2007*. Paper: "Towards microbial synthesis of glucaric acid." Tae Seok Moon [Presenter], Sang-Hwal Yoon, Leah Octavio, Kristala Jones Prather

15. *AIChE Annual Meeting, Salt Lake City, UT, November 2007.* Poster: "*Pseudomonas putida* as a platform for C5 hydroxyacid and lactone synthesis." Collin Martin [Presenter] and Kristala Jones Prather

16. *Society for Industrial Microbiology, 30th Symposium on Biotechnology for Fuels and Chemicals, New Orleans, LA, May 2008.* Paper: "*De novo* biocatalyst design: an alternative strategy for the petroleum-free synthesis of biofuels." Effendi Leonard [Presenter] and Kristala Jones Prather

17. *American Society for Microbiology Annual Meeting, Boston, MA, June 2008.* Poster: "*De novo* biocatalyst design: an alternative strategy for the petroleum-free synthesis of biobutanol." Effendi Leonard [Presenter] and Kristala Jones Prather

18. *Vaccine Technology II, Albufeira, Portugal, June 2008.* Poster: "Rational engineering of an *E. coli* host strain for production of pharmaceutical-grade plasmid DNA." Diana M. Bower [Presenter] and Kristala Jones Prather

19. *American Chemical Society Fall Annual Meeting, Philadelphia, PA, August 2008*. Paper: "Engineering microbial production of glucuronic and glucaric acids." Tae Seok Moon [Presenter], Sang-Hwal Yoon, and Kristala Jones Prather

20. *American Chemical Society Fall Annual Meeting, Philadelphia, PA, August 2008*. Paper: "High-Titer Production of Hydroxyvalerates from Levulinate." Collin Martin and Kristala Jones Prather

21. *Metabolic Engineering VII, Puerto Vallarta, Mexico, September 2008.* Poster: "Microbial synthesis of glucaric and hydroxyvaleric acids." Collin Martin, Tae Seok Moon, Sang-Hwal Yoon, and Kristala Jones Prather [Presenter]

22. *Metabolic Engineering VII, Puerto Vallarta, Mexico, September 2008.* Poster: "Engineering n-butanol production in bacteria." David Nielsen [Presenter], Effendi Leonard, Sang-Hwal Yoon, Hsien-Chung Tseng, and Kristala Jones Prather

23. *AIChE Annual Meeting, Philadelphia, PA, November 2008.* Paper: "Biological production of hydroxyacids from renewable sources." Collin Martin, Hsien-Chung Tseng, and Kristala Jones Prather [Presenter]

24. *AIChE Annual Meeting, Philadelphia, PA, November 2008.* Paper: "Engineering microbial production of glucaric acid." Tae Seok Moon, Sang-Hwal Yoon, and Kristala Jones Prather [Presenter]

25. *AIChE Annual Meeting, Philadelphia, PA, November 2008.* Paper: "Design of *in situ* product recovery devices using polymeric resins." David Nielsen [Presenter] and Kristala Jones Prather

26. *AIChE Annual Meeting, Philadelphia, PA, November 2008.* Poster: "Metabolic engineering of n-butanol production in bacteria." David Nielsen [Presenter], Effendi Leonard, Sang-Hwal Yoon, and Kristala Jones Prather

27. *Biochemical Engineering XVI, Burlington, VT, July 2009.* Poster: "Microbial synthesis of glucaric and hydroxyvaleric acids." Collin Martin, Tae Seok Moon, Sang-Hwal Yoon, John Dueber, and Kristala Jones Prather [Presenter]

28. *Biotechnology Industry Organization (BIO) World Congress on Industrial Biotechnology and Bioprocessing, Montreal, QC, Canada, July 2009*. Oral: "Rational design of microbial chemical factories: enzymes as interchangeable parts." Tae Seok Moon, Sang-Hwal Yoon, John E. Dueber, and Kristala Jones Prather [Presenter]

29. *American Chemical Society Fall Annual Meeting, Washington, DC, August 2009*. Oral: "Enhancing production of glucaric acid from a synthetic pathway in recombinant *Escherichia coli*." Tae Seok Moon [Presenter], John E. Dueber, Sang-Hwal Yoon, Eric Shiue, and Kristala Jones Prather

30. *American Chemical Society Fall Annual Meeting, Washington, DC, August 2009*. Oral: "Biosynthesis of 3,4-dihydroxybutyric acid and 3-hydroxybutyrolactone in *Escherichia coli* from glucose and glycolate." Collin Martin [Presenter] and Kristala Jones Prather

31. *American Chemical Society Fall Annual Meeting, Washington, DC, August 2009*. Poster: "Production of enantiopure hydroxyacids in recombinant *Escherichia coli*." Hsien-Chung Tseng [Presenter], Collin H. Martin, David R. Nielsen, and Kristala Jones Prather

32. *American Chemical Society Fall Annual Meeting, Washington, DC, August 2009*. Poster: "Integrated bioprocessing for the pH-dependent production of 4-valerolactone in *Pseudomonas putida*." Collin H. Martin [Presenter], Danyi Wu, and Kristala Jones Prather

33. *American Chemical Society Fall Annual Meeting, Washington, DC, August 2009*. Poster: "Computational design and selection of glucose oxidase." Tae Seok Moon, Shaun M. Lippow, Subhayu Basu, Sang-Hwal Yoon, Xiazhen Li, Brad Chapman, Keith Robison, Daša Lipovšek, and Kristala Jones Prather

34. *AIChE Annual Meeting, Nashville, TN, November 2009*. Oral: "Integrated bioprocessing for the production of hydroxyvalerates and 4-valerolactone in *Pseudomonas putida*." Collin H. Martin [Presenter], Danyi Wu, and Kristala Jones Prather

35. *AIChE Annual Meeting, Nashville, TN, November 2009*. Oral: "Biosynthesis of 3-hydroxyalkanoic acids and lactones in *Escherichia coli*." Collin Martin [Presenter], Hsien-Chung Tseng, and Kristala Jones Prather

36. *AIChE Annual Meeting, Nashville, TN, November 2009*. Oral: "Enhancing production of glucaric acid from a synthetic pathway in recombinant *Escherichia coli*." Tae Seok Moon [Presenter], John E. Dueber, Sang-Hwal Yoon, Eric Shiue, and Kristala Jones Prather

37. *AIChE Annual Meeting, Nashville, TN, November 2009*. Oral: "Adsorption of second generation biofuels using polymer resins with *in situ* product recovery (ISPR) applications." David R. Nielsen [Presenter] and Kristala Jones Prather

38. *AIChE Annual Meeting, Nashville, TN, November 2009*. Poster: "Computational design and selection of glucose oxidase." Tae Seok Moon [Presenter], Shaun M. Lippow, Subhayu Basu, Sang-Hwal Yoon, Xiazhen Li, Brad Chapman, Keith Robison, Daša Lipovšek, and Kristala Jones Prather

39. *AIChE Annual Meeting, Nashville, TN, November 2009*. Poster: "Production of enantiopure hydroxyacids in recombinant *Escherichia coli*." Hsien-Chung Tseng, Collin H. Martin [Presenter], David R. Nielsen, and Kristala Jones Prather

40. *AIChE Annual Meeting, Nashville, TN, November 2009*. Poster: "Synthesis of acetoin and 2,3-butanediol by engineered *Escherichia coli*." David R. Nielsen [Presenter], Sang-Hwal Yoon, and Kristala Jones Prather

41. *American Chemical Society Spring Annual Meeting, San Francisco, CA, March 2010*. Oral: "Biosynthesis of 3-hydroxyalkanoic acids and lactones in *Escherichia coli*." Collin Martin, Himanshu Dhamankar, Hsien-Chung Tseng, Jeffrey Mo and Kristala Jones Prather [Presenter]

42. *American Chemical Society Spring Annual Meeting, San Francisco, CA, March 2010*. Oral: "Metabolic engineering of *Escherichia coli* for production of chiral hydroxyacids." Hsien-Chung Tseng [Presenter], Catey Harwell, Collin Martin, David Nielsen, and Kristala Jones Prather

43. *Metabolic Engineering VIII, Jeju Island, Republic of Korea, June 2010*. Oral: "Improving productivity of microbial chemical factories using synthetic biology devices." Kristala L. J. Prather

44. *Metabolic Engineering VIII, Jeju Island, Republic of Korea, June 2010*. Poster: "Biosynthesis of 3-Hydroxyalkanoic Acids and Lactones in Escherichia coli." Collin H. Martin, Hsien-Chung Tseng, Himanshu Dhamankar, and Kristala L. J. Prather [Presenter]

45. *AIChE Annual Meeting, Salt Lake City, UT, November 2010*. Oral: "Engineering terpenoid biosynthetic pathway for overproduction and selectivity control." Parayil Ajikumar [Presenter], Effendi Leonard, Kelly Thayer, Wen-Hai Xiao, Jeffrey D. Mo, Bruce Tidor, Gregory Stephanopoulos and Kristala Jones Prather

46. *AIChE Annual Meeting, Salt Lake City, UT, November 2010*. Oral: "Process design for plasmid dna production using microbioreactors." Diana M. Bower [Presenter], Kevin Lee, Rajeev J. Ram, and Kristala L.J. Prather

47. *AIChE Annual Meeting, Salt Lake City, UT, November 2010*. Oral: "Microbial production of high value-added chiral hydroxyacids." Hsien-Chung Tseng [Presenter], Catey L. Harwell, and Kristala L.J. Prather

48. *AIChE Annual Meeting, Salt Lake City, UT, November 2010*. Oral: "A glucose valve for pathway engineering." Kevin V. Solomon [Presenter], Tae Seok Moon, and Kristala L.J. Prather

49. *International Conference on Synthetic Biology, Evry, France, December 2010*. Oral: "Glucose valves: a new device for pathway engineering." Kevin V. Solomon [Presenter] and Kristala L. J. Prather

50. *American Chemical Society Spring Annual Meeting, San Francisco, CA, March 2011*. Oral: "Development of a new R1-based plasmid for DNA vaccine production." Diana M. Bower [Presenter] and Kristala L. J. Prather

51. *American Chemical Society Spring Annual Meeting, San Francisco, CA, March 2011*. Oral: "Glucose valves: Tuning primary metabolism for heterologous production." Kevin V. Solomon [Presenter], Tae Seok Moon, and Kristala L. J. Prather

52. *American Chemical Society Spring Annual Meeting, San Francisco, CA, March 2011*. Oral: "Biosynthesis of 3-hydroxy-γ-butyrolactone and 3,4-dihydroxybutyric acid in Escherichiacoli from glucose as a sole feedstock." Himanshu Dhamankar [Presenter], Collin H. Martin, Kristala L. J. Prather

53. *Biochemical and Molecular Engineering XVII, Seattle, WA, June 2011*. Poster: "Tuning glycolysis for heterologous production." Kevin V. Solomon [Presenter] and Kristala L. J. Prather

54. *AIChE Annual Meeting, Minneapolis, MN, October 2011*. Oral: "Dynamic tuning of glycolytic flux for heterologous production with a 'Glucose Valve'." Kevin V. Solomon [Presenter] and Kristala L.J. Prather

55. *AIChE Annual Meeting, Minneapolis, MN, October 2011*. Oral: "Pathway and host engineering for biosynthesis of 3-hydroxy-γ-butyrolactone and 3,4-dihydroxybutyric acid in *Escherichia coli*." Himanshu Dhamankar [Presenter], Collin H. Martin, and Kristala L.J. Prather

56. *AIChE Annual Meeting, Minneapolis, MN, October 2011*. Oral: "Web-Lab: Enhancing the undergraduate engineering experience." Cynthia Collins and Kristala L.J. Prather [Presenters]

57. *American Chemical Society Spring Annual Meeting, San Diego, CA, March 2012*. Oral: "Platform pathway for synthesis of hydroxyacids as value added products from biomass in *Escherichia coli*." Himanshu Dhamankar [Presenter] and Kristala L. J. Prather

58. *American Chemical Society Spring Annual Meeting, San Diego, CA, March 2012*. Oral: "Process development for a new R1-based plasmid DNA vaccine vector." Diana Bower [Presenter] and Kristala L. J. Prather

59. *Society for Industrial Microbiology & Biotechnology Annual Meeting, Washington, DC, August 2012*. Oral: "A platform pathway for the production of value-added chiral hydroxyacids." Kristala L.J. Prather [Presenter], Himanshu Dhamankar, Collin H. Martin, Hsien-Chung Tseng, Micah J. Sheppard

60. *AIChE Annual Meeting, Pittsburgh, PA, October 2012*. Oral: "Improvement of D-glucaric acid production from a synthetic pathway in *Escherichia coli*." Eric Shiue [Presenter] and Kristala L.J. Prather

61. *AIChE Annual Meeting, Pittsburgh, PA, October 2012*. Oral: "Platform pathway for the synthesis of 3-hydroxyacids as value-added products derived from biomass." Himanshu Dhamankar [Presenter] and Kristala L.J. Prather

62. *4th International Conference on Biomolecular Engineering, Ft. Lauderdale, FL, January 2013*. Poster: "Strategies for increased D-glucaric acid production in *E.coli*." Eric Shiue [Presenter] and Kristala Jones Prather

63. *4th International Conference on Biomolecular Engineering, Ft. Lauderdale, FL, January 2013*. Poster: "Platform pathway for the microbial synthesis of 3-hydroxyacids as value-added products." Himanshu Dhamankar [Presenter] and Kristala L.J. Prather

64. *4th International Conference on Biomolecular Engineering, Ft. Lauderdale, FL, January 2013*. Poster: "Biosynthesis of branched fatty acids via a heterologous fatty acid synthase in E. coli." Micah J. Sheppard [Presenter] and Kristala L.J. Prather

65. *American Chemical Society Spring Annual Meeting, New Orleans, LA, April 2013*. Oral: "Strategies for the improvement of glucaric acid production from a synthetic pathway in *E. coli*." Eric Shiue [Presenter] and Kristala L. J. Prather

66. *American Chemical Society Spring Annual Meeting, New Orleans, LA, April 2013*. Oral: "Biosynthesis of branched short-chain fatty acids via a heterologous fatty acid synthase in *Escherichia coli*." Micah J. Sheppard [Presenter] and Kristala L. J. Prather

67. *American Chemical Society Spring Annual Meeting, New Orleans, LA, April 2013*. Oral: "Exploring a versatile platform pathway for the biosynthesis of 3-hydroxyalkanoicacids as value-added products from biomass in *Escherichia coli*." Himanshu Dhamankar [Presenter] and Kristala L. J. Prather

68. *Society for Industrial Microbiology & Biotechnology Annual Meeting, San Diego, CA, August 2013*. Poster: "A novel pathway for propionyl-CoA production in *E. coli*." Christopher Reisch [Presenter], Catherine Fan, and Kristala L.J. Prather

69. *Society for Industrial Microbiology & Biotechnology Annual Meeting, San Diego, CA, August 2013*. Poster: "Engineering short-chain fatty acid biosynthesis using thioesterase substrate specificity." Matthew McMahon [Presenter] and Kristala L.J. Prather

70. *AIChE Annual Meeting, San Francisco, CA, November 2013*. Oral: "Improving D-glucaric acid production in *E. coli* through directed evolution and delayed induction." Eric Shiue [Presenter] and Kristala L.J. Prather

71. *AIChE Annual Meeting, San Francisco, CA, November 2013*. Oral: "Biosynthesis of a branched C6 fatty alcohol via a *de novo* pathway in *Escherichia coli*." Micah J. Sheppard [Presenter], Spencer Wenck and Kristala L.J. Prather

72. *American Chemical Society Spring Annual Meeting, Dallas, TX, March 2014*. Oral: "Engineering *E. coli* for synthesis of aromatic aldehydes as products or intermediates under aerobic growth." Aditya M. Kunjapur [Presenter] and Kristala L. J. Prather

73. *American Society for Microbiology Annual Meeting, Boston, MA, May 2014*. Oral: "Strategies and pathways for reduced 3C production in *E. coli*." Christopher R. Reisch [Presenter] and Kristala L. J. Prather

74. *AIChE Annual Meeting, Atlanta, GA, November 2014*. Oral: "Dynamic knockdown of *E. coli* central metabolism for redirecting fluxes of primary metabolites." Irene M. Brockman [Presenter] and Kristala L.J. Prather

75. *AIChE Annual Meeting, Atlanta, GA, November 2014*. Oral: "Synthesis and accumulation of aromatic and aliphatic aldehydes in an engineered strain of *Escherichia coli*." Aditya M. Kunjapur [Presenter] and Kristala L.J. Prather

76. *Keystone Symposium on Precision Genome Engineering and Synthetic Biology, Big Sky, MT, January 2015*. Poster: "The no-SCAR (Scarless Cas9 Assisted Recombineering) Method for Genome Editing in *E. coli*." Chris R. Reisch [Presenter] and Kristala L. J. Prather

77. *Keystone Symposium on Precision Genome Engineering and Synthetic Biology, Big Sky, MT, January 2015*. Poster: "Engineering *E. coli* for aldehyde synthesis." Aditya M. Kunjapur [Presenter], Yekaterina Tarasova, and Kristala L. J. Prather

78. *American Chemical Society Spring Annual Meeting, Denver, CO, March 2015*. Oral: "Dynamic knockdown of *E. coli* central metabolism for redirecting fluxes of primary metabolites" Irene M. Brockman [Presenter] and Kristala L. J. Prather

79. *American Chemical Society Spring Annual Meeting, Denver, CO, March 2015*. Oral: "Biosynthesis of key gasoline-range alkanes using engineered *E. coli*." Aditya M. Kunjapur [Presenter] and Kristala L. J. Prather

80. *American Society for Microbiology Annual Meeting, New Orleans, LA, May 2015*. Poster: "Optimization of an Engineered Metabolic Pathway by Kinetic Analysis of an in vitro Reconstituted Enzyme System." Yekaterina Tarasova [Presenter], Brian Bonk, Bruce Tidor, and Kristala L. J. Prather

81. *AIChE Annual Meeting, Salt Lake City, UT, November 2015*. Oral: "Controlling central carbon metabolism for improved pathway yields." Sue Zanne Tan [Presenter] and Kristala L.J. Prather

82. *AIChE Annual Meeting, San Francisco, CA, November 2016*. Oral: " Engineering an Environmentally-Isolated Bacterium for Continuous Biofuel Production and Recovery Under Supercritical CO_2." Jason T. Boock [Presenter], Adam J. E. Freedman, Geoffrey Tompsett, Michael T. Timko, Janelle R. Thompson and Kristala L.J. Prather

83. *Department of Energy Genomic Sciences User Meeting, Washington D.C., February 2017*. Poster: "Systems biology towards a continuous platform for biofuels production: Engineering an environmentally-isolated *Bacillus* strain for biofuel production and recovery under supercritical CO_2." Jason T. Boock [Presenter], Adam J. E. Freedman, Geoffrey Tompsett, Michael T. Timko, Kristala L.J. Prather and Janelle R. Thompson

84. *Joint Genome Institute Genomics of Energy and Environment Meeting, Walnut Creek, CA, March 2017*. Poster: "Assembly, screening, and functional characterization of glucaric acid pathway in model organisms *E. coli* and *S. cerevisiae*." Lisa A Anderson [Presenter], Lisa M. Guay [Presenter], Michael A. Hicks, Eric M. Young, Luis R. Sandoval, Christopher A. Voigt, and Kristala L.J. Prather

85. *Gordon Research Conference on Applied and Environmental Microbiology, South Hadley, MA, July 2017*. Poster: "Engineering an environmentally-isolated strain of *Bacillus megaterium* for biofuel production and recovery under supercritical CO_2." Jason T. Boock [Presenter], Adam J. E. Freedman, Geoffrey Tompsett, Michael T. Timko, Kristala L.J. Prather and Janelle R. Thompson (Honorable mention poster)

86. *Metabolic Engineering Summit, Beijing, China, October 2017*. Poster: "Engineering an environmentally-isolated strain of *Bacillus megaterium* for biofuel production and recovery under supercritical CO_2." Jason T. Boock [Presenter], Adam J. E. Freedman, Geoffrey Tompsett, Michael T. Timko, Janelle R. Thompson and Kristala L.J. Prather (2^{nd} place poster)

87. *Metabolic Engineering Summit, Beijing, China, October 2017*. Poster: "Layered dynamic regulation for improving metabolic pathway productivity." Stephanie Doong [Presenter], Apoorv Gupta and Kristala L.J. Prather

88. *Metabolic Engineering Summit, Beijing, China, October 2017.* Poster: "Improving Glucaric Acid Production by Alleviating Oxidative Stress in *E. coli*." Lisa M. Guay [Presenter] and Kristala L.J. Prather

89. *AIChE Annual Meeting, Minneapolis, MN, October 2017*. Oral: "Engineering an environmentally-isolated strain of *Bacillus megaterium* for biofuel production and recovery under supercritical CO_2." Jason T. Boock [Presenter], Adam J. E. Freedman, Geoffrey Tompsett, Michael T. Timko, Janelle R. Thompson and Kristala L.J. Prather

90. *AIChE Annual Meeting, Minneapolis, MN, November 2017*. Oral: "Bioprospecting to discover keto-aryl reductases with enhanced specificity towards longer-chain, aliphatic substrates." Jason T. Boock [Presenter], Yekaterina Tarasova and Kristala L.J. Prather

91. *AIChE Annual Meeting, Minneapolis, MN, November 2017*. Oral: "Layered dynamic regulation for improving metabolic pathway productivity." Stephanie Doong [Presenter], Apoorv Gupta and Kristala L.J. Prather

92. *AIChE Annual Meeting, Minneapolis, MN, November 2017.* Oral: "Improving Glucaric Acid Production by Alleviating Oxidative Stress in *E. coli*." Lisa M. Guay [Presenter] and Kristala L.J. Prather

93. *EBRC Spring Retreat, Seattle, WA, March 2018*. Poster: "Layered dynamic regulation for improving metabolic pathway productivity." Stephanie J. Doong [Presenter], Apoorv Gupta, Kristala L.J. Prather

94. *Metabolic Engineering 12, Münich, Germany, June 2018*. Poster: "Layered dynamic regulation for improving metabolic pathway productivity." Stephanie J. Doong [Presenter], Apoorv Gupta, Kristala L.J. Prather

95. *EBRC Fall Retreat, Fort Collins, CO, September 2018*. Poster: "Development of a pathway-independent tool for autonomous and dynamic metabolic flux control." Christina V. Dinh [Presenter] and Kristala L. J. Prather

96. *8th Annual SBC @ MIT Symposium, Cambridge, MA, January 2019*. Oral: "Biosprospecting inositol oxidases (MIOX) for improved glucaric acid production in *Saccharomyces cerevisiae*." Wesley L. Marques [Presenter], Lisa A. Anderson, Michael A. Hicks, Kristala L.J. Prather

97. *EBRC Spring Retreat, Boston, MA, March 2019*. Poster: "Biosprospecting inositol oxidases (MIOX) for improved glucaric acid production in *Saccharomyces cerevisiae*." Wesley L. Marques [Presenter], Lisa A. Anderson, Michael A. Hicks, Kristala L.J. Prather

98. *EBRC Spring Retreat, Boston, MA, March 2019*. Poster: "Carbohydrate biosensors and strain engineering in *E. coli* for food waste utilization." Cynthia Ni [Presenter], Kevin J. Fox, Kristala L.J. Prather

99. *American Chemical Society Spring Annual Meeting, Orlando, FL, April 2019.* Oral: "Development of a quorum-sensing circuit for multiplexed metabolic flux control in engineered bacteria." Christina V. Dinh [Presenter] and Kristala L.J. Prather

Activities and Organizations

Advisory committees and service

Chair, Planning Committee, National Academies' Workshop on Successes and Challenges in Biomanufacturing (2022)
Member, National Academies' Committee on Enhancing the U.S. Chemical Economy through Investments in Fundamental Research in the Chemical Sciences (2020-2022)
Member, World Economic Forum Global Future Council (GFC) on Synthetic Biology (2020-2022)
Leadership Advisory Board, Spelman College Center of Excellence for Minority Women in STEM (COE-MWS) (2020-2023)
Nominating Committee, Society for Industrial Microbiology & Biotechnology (2018-2019)
Member, CSIRO Synthetic Biology Future Science Platform ("SynBio FSP") International Advisory Committee (Australia) (2018-2022)
Member, National Academies' Committee on Strategies for Identifying and Addressing Biodefense Vulnerabilities Posed by Synthetic Biology (2017-2018)
Member, World Economic Forum Global Future Council (GFC) on the Future of Biotechnologies (2016-2018)
Member, Department of Energy Biological and Environmental Research Advisory Committee (BERAC) (2016-2024)
Board of Directors, International Metabolic Engineering Society (IMES) (2016-present); Vice President (2019-2021); President (2021-present)
Board of Directors, Engineering Biology Research Consortium (EBRC) (2016-present)
Co-Chair, DOE-BER Workshop on Bioenergy (2014)

Member, National Academies' Committee on the Industrialization of Biology: A Roadmap to Accelerate the Advanced Manufacturing of Chemicals (2014)
AIChE Division 15c Vice-Chair/Chair (Nov 2010 – Nov 2013)
MIT Representative as Expert Witness on Transportation Biofuels, Senate Energy and Natural Resources Committee (Feb 2007)

Scientific journals
Editorial Board, *Current Opinion in Biotechnology* (2021-2024)
Editorial Board, *Metabolic Engineering* (2018-present)
Editorial Board, *Microbial Cell Factories* (2017-present)
Associate Editor, *ACS Synthetic Biology* (2017-present)
Editorial Board, *Cell Chemical Biology* (2015-present)
Associate Editor, *Metabolic Engineering Communications* (2013-2021)
Guest Editor, Biomolecular Engineering Issue, *Biotechnology Journal* (2012-2013)
Guest Editor, Chemical Biotechnology Issue, *Current Opinion in Biotechnology* (2011-2013)
Editorial Board, *Biotechnology and Bioengineering* (2011-present)
Editorial Board, *ACS Synthetic Biology* (2011-present)
Editorial Board, *Biotechnology Journal* (2009-2022)

Industrial Advisory Boards
Scientific advisory board, Thermo Fisher Scientific, Waltham, MA
Scientific advisory board, LanzaTech, Skokie, IL
Scientific advisor, Senda Biosciences, Cambridge, MA
Scientific advisor, Zymochem, San Francisco, CA
Scientific advisor, Synlogic, Cambridge, MA
Scientific advisory board, Manus Bio, Cambridge, MA
Green Chemistry scientific advisory board, Estee Lauder Companies, New York, NY
Board of Directors, Kalion, Inc., Milton, MA
Board of Directors, BioMADE, Minneapolis, MN
Board of Directors, Inscripta, Boulder, CO

Conference planning and coordination
Conference Co-Chair, Biochemical and Molecular Engineering XXII Conference (2018-2022)
Conference Co-Chair, Metabolic Engineering XIII/XIV, (2018-2021)
Steering Committee, Biochemical and Molecular Engineering XXI Conference (2018-2019)
Organizing Committee, International Conference on Biomolecular Engineering (ICBE 2019), sponsored by the Society for Biological Engineering (SBE) (2018-2019)
Session Co-Convener, "Advances in fermentation of microbial communities/mixed cultures," 2018 Society for Industrial Microbiology & Biotechnology Annual Meeting (2017-2018)
Session Co-Chair, "Synthetic Biology and Network Design," Biochemical and Molecular Engineering XX (Jul 2017)
Session Co-Chair, "Metabolic Engineering for Chemicals and Materials," Metabolic Engineering XI Conference (2016)
Scientific Advisory Board, Metabolic Engineering X (2013-2014)
Organizing Committee, 2015 Synthetic Biology: Engineering, Evolution & Design (SEED) Conference (2015)
Organizing Committee, 5th International Conference on Biomolecular Engineering (ICBE), sponsored by the Society for Biological Engineering (SBE) (2014-2015)
Program Chair, 2014 Society for Industrial Microbiology & Biotechnology Annual Meeting (2013-2014)
Conference Co-Chair, 4th International Conference on Biomolecular Engineering (ICBE), sponsored by the Society for Biological Engineering (SBE) (2011-2013)

Program Committee, Metabolic Engineering Track, Society for Industrial Microbiology & Biotechnology (2011-2013)
Session Co-Chair, "Synthetic Systems Biology," AIChE Annual Meeting (Oct 2012)
Session Co-Chair, "Advances in biocatalysis," American Chemical Society National Meeting (Mar 2012)
Program Committee, Session Chair, "Biocatalysis by Design," Society for Industrial Microbiology Annual Meeting (July 2011)
Session Co-Chair, "Novel and Engineered Hosts for Novel Product Applications," American Chemical Society National Meeting (Mar 2011)
Scientific Advisory Committee, "International Conference on Synthetic Biology," Genopole, France (Dec 2010)
Session Co-Chair, "Genomics approaches to systems biology," AIChE Annual Meeting (Nov 2010)
Session Co-Chair, "Metabolic engineering of microorganisms for fuels and chemicals," AIChE Annual Meeting (Nov 2010)
Symposium Co-Chair, "Emerging Technologies," Biotechnology (BIOT) Division, American Chemical Society National Meeting (Aug 2009)
Session Co-Chair, "Novel approaches in metabolic engineering," Biochemical Engineering XVI (Jul 2009)
Session Co-Chair, "Microbial Science and Technology," Society for Industrial Microbiology 31st Symposium on Biotechnology for Fuels and Chemicals (May 2009)
Conference Program Committee, Synthetic Biology 4.0 (Oct 2008)
Poster Session Co-Chair, Conference Planning Committee, Metabolic Engineering VII (Sep 2008)
Session Co-Chair, "Advances in Metabolic Engineering," American Chemical Society National Meeting (Aug 2008)
Session Co-Chair, "Systems Approaches to Synthetic Biology," AIChE Annual Meeting (Nov 2007)
Session Co-Chair, "Physiology and metabolic engineering advancement for protein productivity and process robustness," RAFT VII (Nov 2007)
Conference Planning Committee, Session Co-Chair, "New Frontiers in Metabolic Engineering," Metabolic Engineering VI (Oct 2006)
Session Co-Chair, "Process Development – Molecular and Cellular Biological Issues of R&D," American Chemical Society National Meeting (Sep 2006)
Poster Session Co-Chair, Metabolic Engineering V (Sep 2004)
Conference Co-Chair, Metabolic Engineering IV Conference (Oct 2002)
Poster Session Co-Chair, Metabolic Engineering III Conference (Oct 2000)

Memberships and Offices
Member, American Association for the Advancement of Science (AAAS)
Member, American Chemical Society (ACS), BIOT Division
Member, American Institute of Chemical Engineers (AIChE)
Member, American Society for Microbiology (ASM)
Member, Engineering Biology Research Consortium (EBRC)
    Board of Directors, 2016-2022
    Council Member, 2017-2022
Member, International Metabolic Engineering Society (IMES)
    Board of Directors, 2016-2025
    Vice-President, 2019-2021
    President, 2021-2025
Member, Society for Biological Engineering (SBE)
Member, National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE)

Appendix B

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

CHR. HANSEN HMO GMBH, *Plaintiff and Counterclaim-Defendant,* v. GLYCOSYN LLC, *Defendant and Counterclaim-Plaintiff,* v. ABBOTT LABORATORIES. *Counterclaim-Defendant.*	C.A. No. 1:22-cv-11090-NMG

JOINT CLAIM CONSTRUCTION STATEMENT OF
TERMS TO BE CONSTRUED AND PROPOSED CONSTRUCTIONS

Pursuant to the Local Rule 16.6(e)(1)(D) and the Court's scheduling order (D.I. 68), Plaintiff and Counterclaim-Defendant Chr. Hansen HMO GmbH ("Chr. Hansen"), Counterclaim-Defendant Abbott Laboratories ("Abbott"), and Defendant and Counterclaim-Plaintiff Glycosyn LLC ("Glycosyn") (collectively the "Parties") hereby submit the following joint statement concerning claim construction in the above-caption action.

Agreed Constructions. The Parties are in agreement regarding the construction of the following terms of U.S. Pat. No. 9,970,018 (the "'018 patent"):

Term	Asserted Claims of the '018 patent	Proposed Construction
"wild-type"	Claims 1, 24	Plain and ordinary meaning, *i.e.* "the type most commonly found in nature"
"colanic acid synthesis gene"	Claims 1-3	"a gene involved in a sequence of reactions, usually controlled and catalyzed by enzymes that result in the synthesis of colanic acid"

Term	Asserted Claims of the '018 patent	Proposed Construction
"*E. coli* lacZ gene"	Claim 8	Plain and ordinary meaning, *i.e.* "a structural gene that encodes the β-galactosidase protein and is part of the lac operon in the DNA of *E. coli*"

Disputed Terms. Pursuant to Local Rule 16.6(e), the Parties have been unable to come to an agreement as to the meaning of the terms in Exhibit A, despite meeting and conferring as required by the Local Rules. The disputed terms are set forth in the attached Exhibit A, which notes each Party's respective position on the construction of each term. The Parties intend to continue to meet and confer in an attempt to reduce the number of issues before the Court at claim construction prior to the *Markman* hearing in this matter.

Dated: August 3, 2023

GLYCOSYN LLC	CHR. HANSEN HMO GMBH
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CERTIFICATE OF SERVICE

I hereby certify that on this 3rd day of August, 2023, all counsel of record who are deemed to have consented to electronic service are being served with a true and correct copy of the foregoing document via the Court's CM/ECF system.

/s/ Allison M. Lucier
Allison M. Lucier

EXHIBIT A

EXHIBIT A

TERM	GLYCOSYN'S CONSTRUCTION	CHR. HANSEN & ABBOTT'S CONSTRUCTION	COURT'S CONSTRUCTION
"the level of β-galactosidase activity comprises between 0.05 and [200 units / 5 units / 4 units / 3 units / 2 units]" ('018 patent claims 1, 18, 25-28)	Not indefinite; [1] "when a culture of the *E. Coli* bacteria comprising the exogenous functional β-galactosidase gene is assayed using the Miller protocol, β-galactosidase activity is measurable at between exactly 0.05 and exactly [200/5/4/3/2] Miller Units, as defined in Miller, J.H., Experiments in Molecular Genetics. Cold Spring Harbor Laboratory (Cold Spring Harbor, N.Y.; 1972) at 352-355"	Indefinite; "β-galactosidase activity is measurable at between exactly 0.05 and exactly [200/5/4/3/2] Miller Units, as defined in Miller, J.H., Experiments in Molecular Genetics (Cold Spring Harbor Lab. 1972) at 352-355, where the β-galactosidase activity is the β-galactosidase activity attributable to the expression of the exogenous functional β-galactosidase gene only"	
"[an] exogenous functional β-galactosidase gene"	Plain and ordinary meaning, *i.e.*, "contiguous or non-contiguous DNA originating outside the *E. coli* bacterium	"a single functional sequence of DNA, originating outside the *E. coli* bacterium, that encodes a	

[1] The parties understand that this Court prefers that indefiniteness be addressed at summary judgment. *See Milliman, Inc. v. Gradient A.I. Corp.*, __ F. Supp. 3d __, No. 21-10865-NMG, 2023 U.S. Dist. LEXIS 9172, at *11-12 (D. Mass. Jan. 19, 2023); *Sunrise Techs., Inc. v. Cimcon Lighting, Inc.*, 280 F. Supp. 3d 238, 247 (D. Mass. 2017); *Amax, Inc. v. ACCO Brands Corp.*, 282 F. Supp. 3d 432, 441-42 (D. Mass. 2017); *Momenta Pharms., Inc. v. Amphastar Pharms., Inc.*, 887 F. Supp 2d 303, 313 (D. Mass. 2012); *Koninklijke Philips Elecs. N.V. v. Zoll Med. Corp.*, 914 F. Supp. 2d 89, 100-01 (D. Mass. 2012). Accordingly, the parties will brief indefiniteness at summary judgment and will not address indefiniteness at the claim construction stage. However, for the avoidance of doubt and to reserve their rights, the parties note their respective indefiniteness positions in this chart.

TERM	GLYCOSYN'S CONSTRUCTION	CHR. HANSEN & ABBOTT'S CONSTRUCTION	COURT'S CONSTRUCTION
('018 patent claims 1, 8, 23, 24)	that encodes for a working β-galactosidase enzyme"	working β-galactosidase enzyme"	